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INVESTIGATION OF MICROPULSATION ACTIVITY. 1. MAGAF SYSTEM ADDIT--ETC(U)

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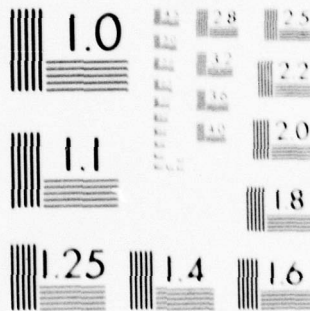
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MICROCOPY RESOLUTION TEST CHART  
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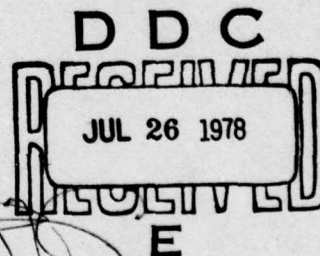
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INVESTIGATION OF MICROPULSATION ACTIVITY  
1. MAGAF SYSTEM ADDITIONS  
2. DATA ANALYSIS

WILLIAM F. BELLEW  
CHARLES J. CANTOR  
M. PATRICIA HAGAN

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400 The Fenway  
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December 1977

Scientific Report no. 2

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UNITED STATES AIR FORCE  
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| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number)<br>Magnetometer Network      Statos Plot<br>CRT Display                      Tektronix<br>Magnetograms                    Permutations<br>Data Storage                      Data Retrieval  |                       |   |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>Systems Additions to the MAGAF data processing system are described herein.<br><br>In the area of data analysis, a program written to generate magnetograms from the MAGAF Network data is described and sample magnetograms are shown. |                       |   |

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|                                 |   |
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| DDC                             | Buff Section <input type="checkbox"/>             |
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| Dist.                           | Avail. and/or SPECIAL                             |
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# I. MAGAF SYSTEM ADDITIONS

A.

SUBROUTINES \$UNPK AND \$REPK

SUBROUTINES \$UNPK AND \$REPK HAVE BEEN WRITTEN RESPECTIVELY TO UNPACK A DATA FRAME FROM RECEIVED DATA ORDER TO INSTRUMENT ORDER (DEFINED IN A PREVIOUS REPORT) AND TO REPACK THE DATA INTO RECEIVED DATA ORDER. SUBROUTINE REPACK IS USED PRIMARILY TO OBTAIN DUMPS FOR HARDWARE DIAGNOSTIC PURPOSES.

A PERMUTATION TABLE (\$CYCST THRU Ø\$CYCND) WHICH DEFINES THE PARTICULAR PERMUTATION FOR THIS PURPOSE HAS BEEN ADDED TO THE IN CORE SYSTEM.

USAGE: DIMENSION IA(245), IB(245)

CALL \$UNPK(IA,IB)

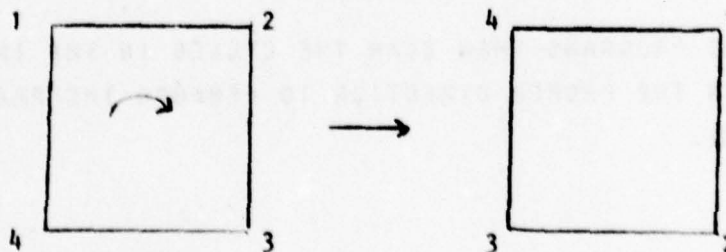
CALL \$REPK(IA,IB)

RESTRICTION: IA AND IB MUST BE DISJOINT OR IDENTICAL.

BECAUSE THE METHOD USED IS GENERALLY APPLICABLE TO ANY PERMUTATION AND ITS INVERSE, A BRIEF DISCUSSION OF METHOD AND A FLOW CHART OF THE PROCEDURE WILL BE GIVEN.

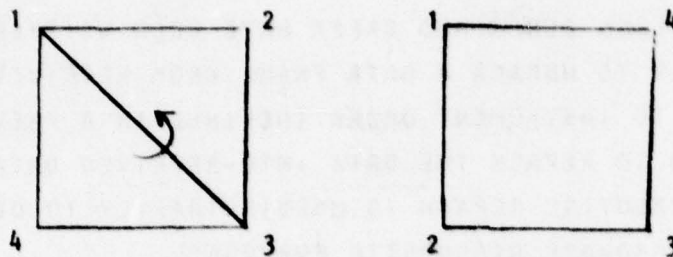
THEORY:

ANY PERMUTATION CAN BE REPRESENTED AS A PRODUCT OF DISJOINT CYCLES, WHERE A CYCLE IS MERELY A TRACING OF ELEMENTS WHICH PERMUTE INTO EACH OTHER. (SEE ANY TEXT ON MODERN ALGEBRA). FOR EXAMPLE, USING PERMUTATIONS OF A SQUARE, ROTATION THROUGH 90°:





CAN BE REPRESENTED AS (1,2,3,4) i.e. 1 GOES TO 2  
GOES TO 3 GOES TO 4 GOES TO 1 AND REFLECTION ABOUT  
A DIAGONAL



CAN BE REPRESENTED AS (1) (3) (2,4).

THE ADVANTAGE OF THIS REPRESENTATION IS THAT THE  
INVERSE PERMUTATION IS IMPLICITLY DEFINED BY THE PER-  
MUTATION ITSELF - READ THE CYCLES BACKWARDS.

#### METHOD:

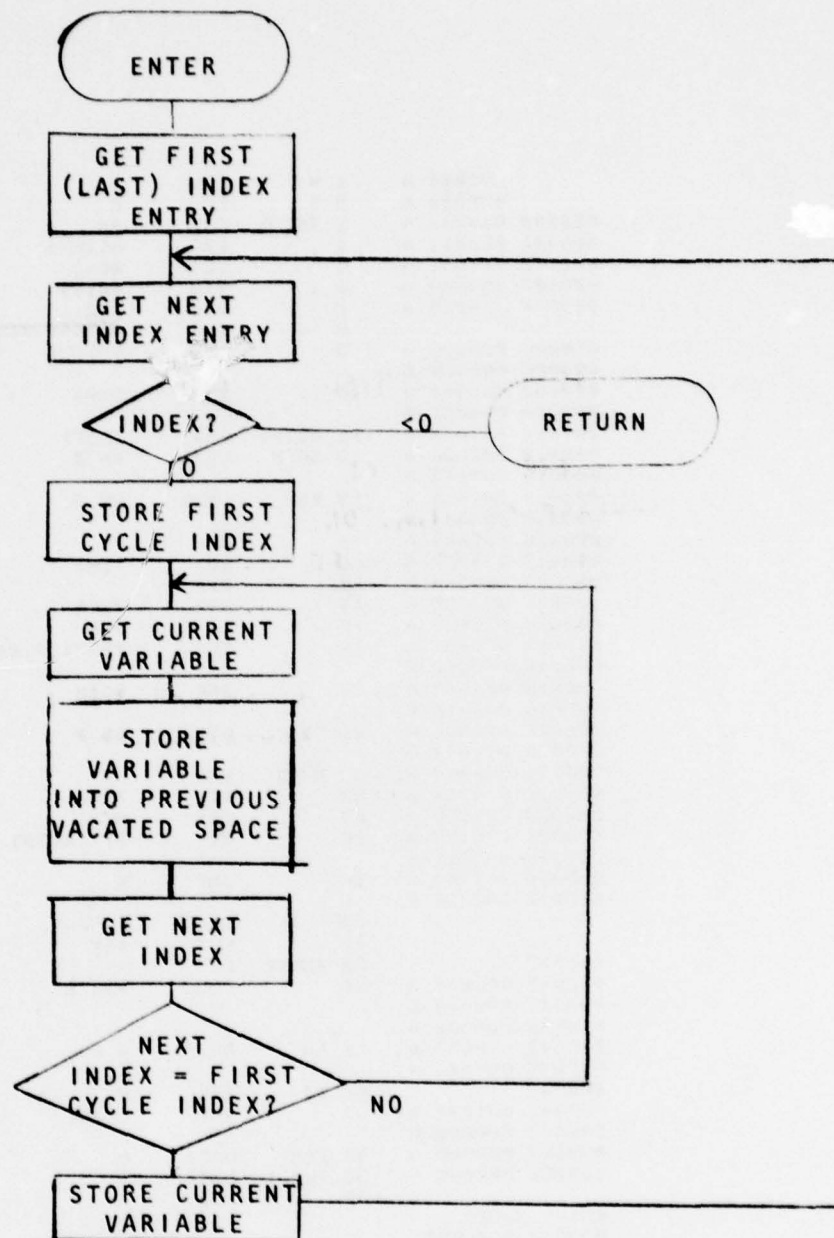
AN INDEX TABLE IS PREPARED WITH NEGATIVE TERMI-  
NATORS AT BOTH ENDS CONTAINING THE CYCLES AUGMENTED  
BY THE START INDEX OF EACH CYCLE.

FOR EXAMPLE THE TABLES FOR THE ROTATION AND  
REFLECTION WOULD BE:

| ROTATION | REFLECTION |
|----------|------------|
| -1       | -1         |
| 1        | 1          |
| 2        | 1          |
| 3        | 3          |
| 4        | 3          |
| 1        | 2          |
| -1       | 4          |
|          | 2          |
|          | -1         |

THE PROGRAMS THEN SCAN THE CYCLES IN THE INDEX  
TABLE IN THE PROPER DIRECTION TO PERFORM THE PER-  
MUTATION.

FLOW CHART:



```

000001 A 1 X EQU 1
000002 A 2 B EQU 2
000000 014042 A 3 SETUP LDA AA
000001 054011 A 4 STA AGIN+1
000002 014041 A 5 LDA AA+1
000003 054024 A 6 STA BB1+1
000004 054010 A 7 STA BB2+1
000005 006030 A 8 EXT $CYCST,$CYCND
000006 000000 E 9 LDNI $CYCND ($CYCST FOR $REPK)
000007 001000 A 10 JMP DXR1
000010 000031 R
000011 064036 A 11 AGIN1 STB TEMP1
000012 006030 A 12 AGIN LDXB AA,B
000013 000043 R
000014 006056 A 13 BB2 STAB BB,B
000015 000044 R
000016 005041 A 14 TXA
000017 034027 A 15 LDX TEMP (1XR FOR $REPK)
000020 005344 A 16 DXR
000021 074025 A 17 STX TEMP
000022 025000 A 18 LDB 0,X
000023 006627 A 19 SRE TEMP1,7,020
000024 000050 R
000025 001000 A 20 JMP AGIN
000026 000012 R
000027 006056 A 21 BB1 STAB BB,B
000030 000044 R (1XR FOR $REPK)
000031 005344 A 22 DXR1 DXR
000032 074014 A 23 STX TEMP
000033 025000 A 24 LDB 0,X
000034 006477 A 25 BT 077,AGIN1 BTB0
000035 000011 R
000036 001000 A 26 JMP 1 ($REPK FOR $REPK)
000037 000026 R
000037 27 NAME $UNPK
000038 28 EXT $SE ($REPK FOR $REPK)
000039 29 $UNPK BES 0
000040 30 CALL $SE,2
000041 000000 E
000042 000002 A
000043 000000 A 31 AA DATA 0,0
000044 000000 A 32 BB BES 0
000045 001000 A 33 JNP SETUP
000046 000000 R
000047 000000 A 34 TEMP DATA 0
000050 000000 A 35 TEMP1 DATA 0
000051 36 END

```

# ENTRY NAMES

000037 R \$UNPK

EXTERNAL NAMES

000006 E \$CYCND 000000 E \$CYCST 000041 E \$SE

# SYMBOLS

000006 E \$CYCND 000000 E \$CYCST 000041 E \$SE 000037 R \$UNPK

000043 R AA 000012 R AGIN 000011 R AGIN1 000002 A B

000044 R BB 000027 R BB1 000014 R BB2 000031 R DXR1

000000 R SETUP 000017 R TEMP 000050 R TEMP1 000001 A X

0 ERRORS ASSEMBLY COMPLETE

|                 |   |             |  |
|-----------------|---|-------------|--|
|                 | 1 |             |  |
|                 | 2 |             |  |
|                 | 3 | NAME        | SCVCST, SCVCND   |
| 000000 177777 A | 4 | SCVCST DATA | -1   |
|                 | 5 | NLIS        |  |
|                 | 6 | DATA        | 0, 4, 16, 64, 55, 24, 92, 179, 189, 3, 13, 51, 8, 32, 140            |
| 000001 000000 A |   |             |  |
| 000002 000004 A |   |             |  |
| 000003 000020 A |   |             |  |
| 000004 000100 A |   |             |  |
| 000005 000067 A |   |             |  |
| 000006 000030 A |   |             |  |
| 000007 000134 A |   |             |  |
| 000010 000263 A |   |             |  |
| 000011 000275 A |   |             |  |
| 000012 000003 A |   |             |  |
| 000013 000015 A |   |             |  |
| 000014 000063 A |   |             |  |
| 000015 000010 A |   |             |  |
| 000016 000040 A |   |             |  |
| 000017 000214 A |   |             |  |
| 000020 000256 A | 7 | DATA        | 174, 78, 125, 117, 69, 74, 93, 182, 212, 215, 218, 221, 224, 227, 95 |
| 000021 000116 A |   |             |  |
| 000022 000175 A |   |             |  |
| 000023 000165 A |   |             |  |
| 000024 000105 A |   |             |  |
| 000025 000112 A |   |             |  |
| 000026 000135 A |   |             |  |
| 000027 000266 A |   |             |  |
| 000030 000324 A |   |             |  |
| 000031 000327 A |   |             |  |
| 000032 000332 A |   |             |  |
| 000033 000335 A |   |             |  |
| 000034 000340 A |   |             |  |
| 000035 000343 A |   |             |  |
| 000036 000137 A |   |             |  |
| 000037 000300 A | 8 | DATA        | 192, 60, 43, 181, 209, 108, 34, 146, 196, 152, 38, 162, 39, 165, 113 |
| 000040 000074 A |   |             |  |
| 000041 000053 A |   |             |  |
| 000042 000265 A |   |             |  |
| 000043 000321 A |   |             |  |
| 000044 000154 A |   |             |  |
| 000045 000042 A |   |             |  |
| 000046 000222 A |   |             |  |
| 000047 000304 A |   |             |  |
| 000050 000230 A |   |             |  |
| 000051 000046 A |   |             |  |
| 000052 000242 A |   |             |  |
| 000053 000047 A |   |             |  |
| 000054 000245 A |   |             |  |
| 000055 000160 A |   |             |  |
| 000056 000062 A | 9 | DATA        | 50, 5, 23, 89, 166, 131, 139, 167, 150, 0                            |
| 000057 000005 A |   |             |  |
| 000060 000027 A |   |             |  |



|        |        |   |    |  |
|--------|--------|---|----|--|
| 000061 | 000131 | A |    |  |
| 000062 | 000246 | A |    |  |
| 000063 | 000203 | A |    |  |
| 000064 | 000213 | A |    |  |
| 000065 | 000247 | A |    |  |
| 000066 | 000226 | A |    |  |
| 000067 | 000000 | A |    |  |
| 000070 | 000001 | A | 10 | DATA 1, 7, 29, 127, 123, 91, 176, 132, 140, 180, 206, 105, 25, 115, 63 |
| 000071 | 000007 | A |    |  |
| 000072 | 000035 | A |    |  |
| 000073 | 000177 | A |    |  |
| 000074 | 000173 | A |    |  |
| 000075 | 000133 | A |    |  |
| 000076 | 000260 | A |    |  |
| 000077 | 000204 | A |    |  |
| 000100 | 000216 | A |    |  |
| 000101 | 000264 | A |    |  |
| 000102 | 000316 | A |    |  |
| 000103 | 000151 | A |    |  |
| 000104 | 000031 | A |    |  |
| 000105 | 000163 | H |    |  |
| 000106 | 000077 | A |    |  |
| 000107 | 000064 | A | 11 | DATA 52, 11, 45, 191, 41, 175, 113, 53, 14, 54, 17, 67, 63, 71, 34     |
| 000110 | 000013 | A |    |  |
| 000111 | 000055 | A |    |  |
| 000112 | 000277 | A |    |  |
| 000113 | 000051 | A |    |  |
| 000114 | 000257 | H |    |  |
| 000115 | 000161 | A |    |  |
| 000116 | 000065 | A |    |  |
| 000117 | 000016 | H |    |  |
| 000120 | 000066 | A |    |  |
| 000121 | 000021 | A |    |  |
| 000122 | 000103 | H |    |  |
| 000123 | 000104 | A |    |  |
| 000124 | 000107 | A |    |  |
| 000125 | 000124 | H |    |  |
| 000126 | 000223 | A | 12 | DATA 147, 199, 98, 201, 100, 6, 26, 113, 72, 87, 160, 1                |
| 000127 | 000307 | H |    |  |
| 000130 | 000142 | A |    |  |
| 000131 | 000311 | A |    |  |
| 000132 | 000144 | A |    |  |
| 000133 | 000006 | A |    |  |
| 000134 | 000032 | A |    |  |
| 000135 | 000166 | A |    |  |
| 000136 | 000110 | A |    |  |
| 000137 | 000127 | A |    |  |
| 000140 | 000240 | A |    |  |
| 000141 | 000001 | A |    |  |
| 000142 | 000002 | A | 13 | DATA 2, 10, 42, 178, 170, 2  |
| 000143 | 000012 | H |    |  |
| 000144 | 000052 | A |    |  |
| 000145 | 000262 | A |    |  |

|        |        |   |    |      |  |
|--------|--------|---|----|------|--|
| 000146 | 000252 | A |    |      |  |
| 000147 | 000002 | A |    |      |  |
| 000150 | 000011 | A | 14 | DATA | 9, 35, 153, 57, 30, 134, 143, 202, 101, 9                          |
| 000151 | 000043 | A |    |      |  |
| 000152 | 000231 | A |    |      |  |
| 000153 | 000071 | A |    |      |  |
| 000154 | 000036 | A |    |      |  |
| 000155 | 000206 | A |    |      |  |
| 000156 | 000224 | A |    |      |  |
| 000157 | 000312 | A |    |      |  |
| 000160 | 000145 | A |    |      |  |
| 000161 | 000011 | A |    |      |  |
| 000162 | 000014 | A | 15 | DATA | 12, 48, 200, 99, 204, 103, 15, 61, 46, 194, 114, 56, 27, 121, 85   |
| 000163 | 000060 | A |    |      |  |
| 000164 | 000310 | A |    |      |  |
| 000165 | 000143 | A |    |      |  |
| 000166 | 000314 | A |    |      |  |
| 000167 | 000147 | A |    |      |  |
| 000170 | 000017 | A |    |      |  |
| 000171 | 000075 | A |    |      |  |
| 000172 | 000056 | A |    |      |  |
| 000173 | 000302 | A |    |      |  |
| 000174 | 000162 | A |    |      |  |
| 000175 | 000070 | A |    |      |  |
| 000176 | 000033 | A |    |      |  |
| 000177 | 000171 | A |    |      |  |
| 000200 | 000125 | A |    |      |  |
| 000201 | 000232 | A | 16 | DATA | 154, 76, 119, 75, 116, 66, 65, 62, 49, 203, 102, 12                |
| 000202 | 000114 | A |    |      |  |
| 000203 | 000167 | A |    |      |  |
| 000204 | 000113 | A |    |      |  |
| 000205 | 000164 | A |    |      |  |
| 000206 | 000102 | A |    |      |  |
| 000207 | 000101 | A |    |      |  |
| 000210 | 000076 | A |    |      |  |
| 000211 | 000061 | A |    |      |  |
| 000212 | 000313 | A |    |      |  |
| 000213 | 000146 | A |    |      |  |
| 000214 | 000014 | A |    |      |  |
| 000215 | 000022 | A | 17 | DATA | 18, 70, 81, 138, 164, 77, 122, 88, 163, 58, 33, 143, 183, 207, 106 |
| 000216 | 000106 | A |    |      |  |
| 000217 | 000121 | A |    |      |  |
| 000220 | 000212 | A |    |      |  |
| 000221 | 000244 | A |    |      |  |
| 000222 | 000115 | A |    |      |  |
| 000223 | 000172 | A |    |      |  |
| 000224 | 000130 | A |    |      |  |
| 000225 | 000243 | A |    |      |  |
| 000226 | 000072 | A |    |      |  |
| 000227 | 000041 | A |    |      |  |
| 000230 | 000217 | A |    |      |  |
| 000231 | 000267 | A |    |      |  |
| 000232 | 000317 | A |    |      |  |

|        |        |   |    |      |   |
|--------|--------|---|----|------|---|
| 000233 | 000152 | A |    |      |   |
| 000234 | 000034 | A | 18 | DATA | 38, 124, 94, 185, 213, 216, 219, 222, 225, 228, 96, 195, 133, 145, 193  |
| 000235 | 000174 | A |    |      |   |
| 000236 | 000136 | A |    |      |   |
| 000237 | 000271 | A |    |      |   |
| 000240 | 000325 | A |    |      |   |
| 000241 | 000330 | A |    |      |   |
| 000242 | 000333 | A |    |      |   |
| 000243 | 000336 | A |    |      |   |
| 000244 | 000341 | A |    |      |   |
| 000245 | 000344 | A |    |      |   |
| 000246 | 000140 | A |    |      |   |
| 000247 | 000303 | A |    |      |   |
| 000250 | 000205 | A |    |      |   |
| 000251 | 000221 | A |    |      |   |
| 000252 | 000301 | A |    |      |   |
| 000253 | 000117 | A | 19 | DATA | 79, 128, 126, 120, 82, 141, 177, 151, 19, 73, 90, 173, 59, 36, 156      |
| 000254 | 000200 | A |    |      |   |
| 000255 | 000176 | A |    |      |   |
| 000256 | 000170 | A |    |      |   |
| 000257 | 000122 | A |    |      |   |
| 000260 | 000215 | A |    |      |   |
| 000261 | 000261 | A |    |      |   |
| 000262 | 000227 | A |    |      |   |
| 000263 | 000023 | A |    |      |   |
| 000264 | 000111 | A |    |      |   |
| 000265 | 000132 | A |    |      |   |
| 000266 | 000255 | A |    |      |   |
| 000267 | 000073 | A |    |      |   |
| 000270 | 000044 | A |    |      |   |
| 000271 | 000234 | A |    |      |   |
| 000272 | 000202 | A | 20 | DATA | 130, 136, 158, 168, 169, 188, 214, 217, 220, 223, 226, 229, 97, 193, 19 |
| 000273 | 000210 | A |    |      |   |
| 000274 | 000236 | A |    |      |   |
| 000275 | 000250 | A |    |      |   |
| 000276 | 000251 | A |    |      |   |
| 000277 | 000274 | A |    |      |   |
| 000300 | 000326 | A |    |      |   |
| 000301 | 000331 | A |    |      |   |
| 000302 | 000334 | A |    |      |   |
| 000303 | 000337 | A |    |      |   |
| 000304 | 000342 | A |    |      |   |
| 000305 | 000345 | A |    |      |   |
| 000306 | 000141 | A |    |      |   |
| 000307 | 000306 | A |    |      |   |
| 000310 | 000276 | A |    |      |   |
| 000311 | 000026 | A | 21 | DATA | 22, 86, 157, 149, 205, 104, 18  |
| 000312 | 000126 | A |    |      |   |
| 000313 | 000235 | A |    |      |   |
| 000314 | 000225 | A |    |      |   |
| 000315 | 000315 | A |    |      |   |
| 000316 | 000150 | A |    |      |   |
| 000317 | 000022 | A |    |      |   |

|        |        |   |    |             |   |
|--------|--------|---|----|-------------|---|
| 000320 | 000024 | A | 22 | DATA        | 20, 80, 135, 155, 111, 47, 197, 171, 21, 83, 144, 196, 208, 107, 31 |
| 000321 | 000120 | A |    |             |   |
| 000322 | 000207 | A |    |             |   |
| 000323 | 000233 | A |    |             |   |
| 000324 | 000157 | A |    |             |   |
| 000325 | 000057 | A |    |             |   |
| 000326 | 000305 | A |    |             |   |
| 000327 | 000253 | A |    |             |   |
| 000330 | 000025 | A |    |             |   |
| 000331 | 000123 | A |    |             |   |
| 000332 | 000220 | A |    |             |   |
| 000333 | 000272 | A |    |             |   |
| 000334 | 000320 | A |    |             |   |
| 000335 | 000153 | A |    |             |   |
| 000336 | 000037 | A |    |             |   |
| 000337 | 000211 | A | 23 | DATA        | 137, 161, 20  |
| 000340 | 000241 | A |    |             |   |
| 000341 | 000024 | A |    |             |   |
| 000342 | 000045 | A | 24 | DATA        | 37, 159, 187, 211, 110, 44, 184, 210, 109, 37                       |
| 000343 | 000237 | A |    |             |   |
| 000344 | 000273 | A |    |             |   |
| 000345 | 000323 | A |    |             |   |
| 000346 | 000156 | A |    |             |   |
| 000347 | 000054 | A |    |             |   |
| 000350 | 000270 | A |    |             |   |
| 000351 | 000322 | A |    |             |   |
| 000352 | 000155 | A |    |             |   |
| 000353 | 000045 | A |    |             |   |
| 000354 | 000050 | A | 25 | DATA        | 40, 172, 40   |
| 000355 | 000254 | A |    |             |   |
| 000356 | 000050 | A |    |             |   |
| 000357 | 000201 | A | 26 | DATA        | 129, 129  |
| 000360 | 000201 | A |    |             |   |
| 000361 | 000346 | A | 27 | DATA        | 230, 230  |
| 000362 | 000346 | A |    |             |   |
| 000363 | 000347 | A | 28 | DATA        | 231, 231  |
| 000364 | 000347 | A |    |             |   |
| 000365 | 000350 | A | 29 | DATA        | 232, 232  |
| 000366 | 000350 | A |    |             |   |
| 000367 | 000351 | A | 30 | DATA        | 233, 233  |
| 000370 | 000351 | A |    |             |   |
| 000371 | 000352 | A | 31 | DATA        | 234, 234  |
| 000372 | 000352 | A |    |             |   |
| 000373 | 000353 | A | 32 | DATA        | 235, 235  |
| 000374 | 000353 | A |    |             |   |
| 000375 | 000354 | A | 33 | DATA        | 236, 236  |
| 000376 | 000354 | A |    |             |   |
| 000377 | 000355 | A | 34 | DATA        | 237, 237  |
| 000400 | 000355 | A |    |             |   |
| 000401 | 000356 | A | 35 | DATA        | 238, 238  |
| 000402 | 000356 | A |    |             |   |
| 000403 | 000357 | A | 36 | DATA        | 239, 239  |
| 000404 | 000357 | A |    |             |   |
| 000405 | 000360 | A | 37 | DATA        | 240, 240  |
| 000406 | 000360 | A |    |             |   |
| 000407 | 000361 | A | 38 | DATA        | 241, 241  |
| 000410 | 000361 | A |    |             |   |
| 000411 | 000362 | A | 39 | DATA        | 242, 242  |
| 000412 | 000362 | A |    |             |   |
| 000413 | 000363 | A | 40 | DATA        | 243, 243  |
| 000414 | 000363 | A |    |             |   |
| 000415 | 000364 | A | 41 | DATA        | 244, 244  |
| 000416 | 000364 | A |    |             |   |
|        |        |   | 42 | LIST        |   |
| 000417 | 177777 | A | 43 | SCYCND DATA | -1  |
|        |        |   | 44 | END         |   |

ENTRY NAMES

000417 R SCYCND 000000 R SCYCST

EXTERNAL NAMES

SYMBOLS

000417 R SCYCND 000000 R SCYCST

0 ERRORS ASSEMBLY COMPLETE



B.

DATA STORAGE AND RETRIEVAL SUBROUTINES

THE DATA STORAGE AND RETRIEVAL SUBROUTINES ARE DESIGNED TO FACILITATE THE STORAGE AND RETRIEVAL OF TIME SERIES DATA WITHOUT REQUIRING INORDINATE AMOUNTS OF CORE. THERE ARE SIX SUBROUTINES, EACH OF WHICH WILL BE DESCRIBED.

ROUTINE: OP\$N

CALLING SEQUENCE: CALL OP\$N (BUFFER,NVAR)

BUFFER - FLOATING POINT ARRAY OF DIMENSION AT  
LEAST 60\*NVAR (120\*NVAR FOR FIXED POINT)

NVAR - NUMBER OF VARIABLES

OP\$N - MUST BE CALLED BEFORE ANY OTHER ROUTINES TO  
OPEN THE DISKFILE (PLOTFL ON UNTIL 30) AND  
SETUP FOR OTHER ROUTINES

ROUTINE: ADDCMP (ADD COMPONENT)

CALLING SEQUENCE: CALL ADDCMP(A,I)

A - VARIABLE TO BE ADDED

I - INDEX OF VARIABLE SNNAR

ROUTINE: RETRIV

CALLING SEQUENCE: CALL RETRIV(VECT,I)

VECT - VECTOR WHICH IS TO BE RETURNED

I - INDEX OF VARIABLE

ROUTINE: CLO\$E

CALLING SEQUENCE: CALL CLO\$E

CLOSES DISKFILE AND UPDATES IT. REOPENS IT  
FOR LATER USE

NOTE: FOR PROPER PROGRAM FUNCTIONING, ADDCMP MUST  
HAVE BEEN CALLED THE SAME NUMBER OF TIMES  
FOR EACH INDEX, AND THAT NUMBER MUST BE A  
MULTIPLE OF 60.

ROUTINE: CLOSE

CALLING SEQUENCE: CALL CLOSE

CLOSE DISK FILE AND UP DATE IT. REOPEN IT  
FOR LATER USE.

NOTE: FOR PROPER PROGRAM FUNCTIONING, ADDCMP MUST HAVE  
BEEN CALLED THE SAME NUMBER OF TIMES FOR EACH  
INDEX AND THAT NUMBER MUST BE A MULTIPLE OF 60.

ROUTINE: OP\$N1, CLOS1

CALLING SEQUENCE: CALL (OP\$N1) (IFIRST, ILAST)  
(CLOS1)

(OP\$N1 RETRIEVES) DATA BETWEEN IFIRST AND ILAST (FROM) DISK.  
(CLOS1 STORES ) ( TO )

EXAMPLE: A TAPE EXISTS IN THE FOLLOWING CARD IMAGE FORMAT.

RECORD 1 - Alphabetic ID.

RECORD 2 -  $n_1 - X_1 - X_{20}$  - OBSERVATIONS OF 20  
VARIABLES (20F4.0)  $n \leq 2401$

PROBLEM: TO STORE THE DATA MATRIX ON DISK, LATER  
TO PRINT OUT THE DATA VARIABLE BY VARIABLE.

```
DIMENSION ID(40) BUFFER(1200) X(20)
COMMON /XXXX/ ID,N
REWIND 21

READ (21,100) ID
100 FORMAT (40A2)
N=0

CALL OP$N(BUFFER,20)
1 READ (21,101) X
101 FORMAT (20F40)

IF (IOCHK(21)) 2,3,4
2 BACKSPACE 21
GO TO 1

3 N=N+1
DO 5 I=1, 20
5 CALL ADDCMP(X(I),1)

GO TO 1
4 NADD=MOD(N,60)
IF (NADD.EQ. 0) GO TO 99

DO 6 I=1,NADD
DO 6 J=1,20
6 CALL ADDCMP(0.0,J)

99 CALL CLOS1(ID,ID(41))
STOP
END

DIMENSION ID(41), VECT(2400)
CALL OP$N(VECT,20)
CALL OP$N1(ID,ID(41))

N=ID(41)
DO 1 I=1,20
CALL RETRIV (VECT,I)

1 WRITE (5,100) (ID(J),J=1,40), (VECT(I)J)
1 WRITE (5,100) (ID(J), J=1,40), (VECT(I)J=1,N)
100 FORMAT(1H1,40A2/(1X,30F4.0))

END
```

|        |          |  | 1        | NAME | OP\$N,CLOSE,RETRIV,ADDCMP,OP\$N |
|--------|----------|--|----------|------|---------------------------------|
|        |          |  | 2        | EXT  | \$SE                            |
|        | 000422 A |  | 3 TWO    | EQU  | 0422                            |
|        | 000001 A |  | 4 X      | EQU  | 1                               |
|        | 000002 A |  | 5 B      | EQU  | 2                               |
| 000000 | 000000 A |  | 6 OP\$N1 | ENTR |                                 |
| 000001 | 002000 A |  | 7        | CALL | \$SE,2,0,0                      |
| 000002 | 000000 E |  |          |      |                                 |
| 000003 | 000002 A |  |          |      |                                 |
| 000004 | 000000 A |  |          |      |                                 |
| 000005 | 000000 A |  |          |      |                                 |
| 000006 | 002000 A |  | 8        | CALL | SAVE                            |
| 000007 | 000062 R |  |          |      |                                 |
| 000010 | 005001 A |  | 9        | TZA  |                                 |
| 000011 | 006506 A |  | 10       | JSR  | RDW,B                           |
| 000012 | 000026 R |  |          |      |                                 |
| 000013 | 000000 A |  | 11 CLOS1 | ENTR |                                 |
| 000014 | 002000 A |  | 12       | CALL | \$SE,2,0,0                      |
| 000015 | 000002 E |  |          |      |                                 |
| 000016 | 000002 A |  |          |      |                                 |
| 000017 | 000000 A |  |          |      |                                 |
| 000020 | 000000 A |  |          |      |                                 |
| 000021 | 002000 A |  | 13       | CALL | SAVE                            |
| 000022 | 000062 R |  |          |      |                                 |
| 000023 | 005101 A |  | 14       | INCR | 01                              |
| 000024 | 006506 A |  | 15       | JSR  | RDW,B                           |
| 000025 | 000026 R |  |          |      |                                 |
| 000026 | 004250 A |  | 16 RDW   | LRLA | S                               |
| 000027 | 124073 A |  | 17       | ADD  | READ+3                          |
| 000030 | 054021 A |  | 18       | STA  | RDW1+3                          |
| 000031 | 005101 A |  | 19       | INCR | 01                              |
| 000032 | 054304 A |  | 20       | STA  | FCB+3                           |
| 000033 | 005021 A |  | 21       | TBA  |                                 |
| 000034 | 006140 A |  | 22       | SUBI | CLOS1-OP\$N1                    |
| 000035 | 000013 A |  |          |      |                                 |
| 000036 | 005014 A |  | 23       | TAX  |                                 |
| 000037 | 015000 A |  | 24       | LDA  | 0,X                             |
| 000040 | 054027 A |  | 25       | STA  | RETRN                           |
| 000041 | 015004 A |  | 26       | LDA  | 4,X                             |
| 000042 | 054272 A |  | 27       | STA  | FCB+1                           |
| 000043 | 005211 A |  | 28       | CPA  |                                 |
| 000044 | 120422 A |  | 29       | ADD  | TWO                             |
| 000045 | 125005 A |  | 30       | ADD  | 5,X                             |
| 000046 | 054265 A |  | 31       | STA  | FCB                             |
|        |          |  | 32 RDW1  | READ | FCB,30                          |
| 000047 | 006505 A |  |          |      |                                 |
| 000050 | 000000 E |  |          |      |                                 |
| 000051 | 100000 A |  |          |      |                                 |
| 000052 | 000036 A |  |          |      |                                 |
| 000053 | 000134 R |  |          |      |                                 |
| 000054 | 000000 A |  |          |      |                                 |
| 000055 | 000000 A |  |          |      |                                 |
| 000056 | 014267 A |  | 33       | LDA  | D120                            |

|        |        |   |    |       |              |
|--------|--------|---|----|-------|--------------|
| 000057 | 054254 | A | 34 | STA   | FCB          |
| 000060 | 001000 | A | 35 | JMP   | RETRN+1      |
| 000061 | 000071 | R |    |       |              |
| 000062 | 000000 | A | 36 | SAVE  | ENTR         |
| 000063 | 054012 | A | 37 | STA   | STA          |
| 000064 | 064012 | A | 38 | STB   | STB          |
| 000065 | 074012 | A | 39 | STX   | STX          |
| 000066 | 001000 | A | 40 | RETU* | SAVE         |
| 000067 | 100062 | R |    |       |              |
| 000070 | 000000 | A | 41 | RETRN | ENTR         |
| 000071 | 014004 | A | 42 | LDA   | STA          |
| 000072 | 024004 | A | 43 | LDB   | STB          |
| 000073 | 034004 | A | 44 | LDX   | STX          |
| 000074 | 001000 | A | 45 | RETU* | RETRN        |
| 000075 | 100070 | R |    |       |              |
| 000076 | 000000 | A | 46 | STA   | DATA 0       |
| 000077 | 000000 | A | 47 | STB   | DATA 0,0     |
| 000100 | 000000 | A |    |       |              |
| 000100 |        |   | 48 | STX   | BES 0        |
|        |        |   | 49 | *     |              |
|        |        |   | 50 | *     |              |
| 000101 | 002000 | A | 51 | RETR1 | CALL SAVE    |
| 000102 | 000062 | R |    |       |              |
| 000103 | 014045 | A | 52 | LDA   | WHERE        |
| 000104 | 054230 | A | 53 | STA   | FCB+1        |
|        |        |   | 54 | OPEN  | FCB, 30      |
| 000105 | 006505 | A |    |       |              |
| 000106 | 000050 | E |    |       |              |
| 000107 | 100000 | A |    |       |              |
| 000110 | 003036 | A |    |       |              |
| 000111 | 000334 | R |    |       |              |
| 000112 | 000000 | A |    |       |              |
| 000113 | 000000 | A |    |       |              |
| 000114 | 006017 | A | 55 | LDAEX | ICM1         |
| 000115 | 100152 | P |    |       |              |
| 000116 | 005111 | A | 56 | IAR   |              |
| 000117 | 054217 | A | 57 | STA   | FCB+3        |
|        |        |   | 58 | READ  | READ FCB, 30 |
| 000120 | 006505 | A |    |       |              |
| 000121 | 000106 | E |    |       |              |
| 000122 | 100000 | A |    |       |              |
| 000123 | 000036 | A |    |       |              |
| 000124 | 000334 | R |    |       |              |
| 000125 | 000000 | A |    |       |              |
| 000126 | 000000 | A |    |       |              |
| 000127 | 014205 | A | 59 | LDA   | FCB+1        |
| 000130 | 124215 | A | 60 | ADD   | D120         |
| 000131 | 054203 | A | 61 | STA   | FCB+1        |
| 000132 | 014204 | A | 62 | LDA   | FCB+3        |
| 000133 | 124175 | A | 63 | ADD   | HCOMP        |
| 000134 | 054202 | A | 64 | STA   | FCB+3        |
| 000135 | 124203 | A | 65 | ADD   | FCB+5        |
| 000136 | 144201 | A | 66 | SUB   | FCB+4        |



|        |        |   |     |        |                   |
|--------|--------|---|-----|--------|-------------------|
| 000137 | 005311 | A | 67  | DAR    |                   |
| 000140 | 001004 | A | 68  | JAN    | READ              |
| 000141 | 000120 | R |     |        |                   |
| 000142 | 002000 | A | 69  | CALL   | RETRN             |
| 000143 | 000070 | R |     |        |                   |
| 000144 | 001000 | A | 70  | JMP    | *                 |
| 000145 | 000144 | R |     |        |                   |
| 000145 |        |   | 71  | RETRIV | BES 0             |
| 000146 | 002000 | A | 72  | CALL   | %SE,2             |
| 000147 | 000015 | E |     |        |                   |
| 000150 | 000002 | A |     |        |                   |
| 000151 | 000000 | A | 73  | WHERE  | DATA 0            |
| 000152 | 000000 | A | 74  | ICM1   | DATA 0            |
| 000153 | 001000 | A | 75  | JMP    | RETR1             |
| 000154 | 000101 | R |     |        |                   |
|        |        |   | 76  | *      |                   |
|        |        |   | 77  | *      |                   |
| 000155 | 002000 | A | 78  | ADDCM1 | CALL SAVE         |
| 000156 | 000062 | R |     |        |                   |
| 000157 | 006027 | A | 79  | LDBEX  | ICOMP             |
| 000160 | 100220 | R |     |        |                   |
| 000161 | 005322 | A | 80  | DBR    |                   |
| 000162 | 064035 | A | 81  | STB    | ICOMP             |
| 000163 | 006216 | A | 82  | LDAE   | STPCMP,B,0200     |
| 000164 | 000427 | R |     |        |                   |
| 000165 | 054147 | A | 83  | STA    | FCB11             |
| 000166 | 006328 | A | 84  | ADDE   | NCMPS,B,0200      |
| 000167 | 000377 | R |     |        |                   |
| 000170 | 005014 | A | 85  | TAX    |                   |
| 000171 | 024025 | A | 86  | LDB    | A                 |
| 000172 | 016000 | A | 87  | LDA    | 0,B               |
| 000173 | 055000 | A | 88  | STA    | 0,X               |
| 000174 | 016001 | A | 89  | LDA    | 1,B               |
| 000175 | 055001 | A | 90  | STA    | 1,X               |
| 000176 | 024021 | A | 91  | LDB    | ICOMP             |
| 000177 | 006216 | A | 92  | LDAE   | NCMPS,B,0200      |
| 000200 | 000377 | R |     |        |                   |
| 000201 | 120422 | A | 93  | ADD    | TWO               |
| 000202 | 005014 | A | 94  | TAX    |                   |
| 000203 | 144142 | A | 95  | SUB    | D120              |
| 000204 | 001010 | A | 96  | JAZ    | WRITE             |
| 000205 | 000223 | R |     |        |                   |
| 000206 | 006276 | A | 97  | RET1   | STXE NCMPS,B,0200 |
| 000207 | 000377 | R |     |        |                   |
| 000210 | 002000 | A | 98  | CALL   | RETRN             |
| 000211 | 000070 | R |     |        |                   |
| 000212 | 001000 | A | 99  | JMP    | *                 |
| 000213 | 000212 | R |     |        |                   |
| 000213 |        |   | 100 | ADDCMP | BES 0             |
| 000214 | 002000 | A | 101 | CALL   | %SE,2             |
| 000215 | 000147 | E |     |        |                   |
| 000216 | 000002 | A |     |        |                   |
| 000217 | 000000 | A | 102 | A      | DATA 0            |

|        |        |   |     |       |       |                |
|--------|--------|---|-----|-------|-------|----------------|
| 000220 | 000000 | A | 103 | ICOMP | DATA  | 0              |
| 000221 | 001000 | A | 104 |       | JMP   | ADDCM1         |
| 000222 | 000155 | R |     |       |       |                |
| 000223 | 006216 | A | 105 | WRITE | LDNE  | RECNO, B, 0200 |
| 000224 | 000347 | R |     |       |       |                |
| 000225 | 054111 | A | 106 |       | STA   | FCB+3          |
| 000226 | 124102 | A | 107 |       | ADD   | NOOMP          |
| 000227 | 006256 | A | 108 |       | STOE  | RECNO, B, 0200 |
| 000230 | 000347 | R |     |       |       |                |
|        |        |   | 109 |       | WRITE | FCB, 30        |
| 000231 | 006505 | A |     |       |       |                |
| 000232 | 000121 | E |     |       |       |                |
| 000233 | 100000 | A |     |       |       |                |
| 000234 | 000436 | A |     |       |       |                |
| 000235 | 000334 | R |     |       |       |                |
| 000236 | 000000 | A |     |       |       |                |
| 000237 | 000000 | A |     |       |       |                |
| 000240 | 005004 | A | 110 |       | TX    |                |
| 000241 | 001000 | A | 111 |       | JMP   | RET1           |
| 000242 | 000206 | R |     |       |       |                |
|        |        |   | 112 | *     |       |                |
|        |        |   | 113 | *     |       |                |
| 000243 | 000000 | A | 114 | CLOSE | ENTR  |                |
| 000244 | 002000 | A | 115 |       | CALL  | SAVE           |
| 000245 | 000062 | R |     |       |       |                |
| 000246 | 014100 | A | 116 |       | LDA   | RECNO          |
| 000247 | 054067 | A | 117 |       | STA   | FCB+3          |
|        |        |   | 118 |       | CLOSE | FCB, 30, , 1   |
| 000250 | 006505 | A |     |       |       |                |
| 000251 | 000232 | E |     |       |       |                |
| 000252 | 100000 | A |     |       |       |                |
| 000253 | 013436 | A |     |       |       |                |
| 000254 | 000334 | R |     |       |       |                |
| 000255 | 000000 | A |     |       |       |                |
| 000256 | 000000 | A |     |       |       |                |
| 000257 | 002000 | A | 119 |       | CALL  | RETRN          |
| 000260 | 000070 | R |     |       |       |                |
| 000261 | 001000 | A | 120 |       | RETU* | CLOSE          |
| 000262 | 100243 | R |     |       |       |                |
|        |        |   | 121 | *     |       |                |
|        |        |   | 122 | *     |       |                |
| 000263 | 002000 | A | 123 | OPN1  | CALL  | SAVE           |
| 000264 | 000062 | R |     |       |       |                |
| 000265 | 006037 | A | 124 |       | LDXE* | NOOMP          |
| 000266 | 100331 | R |     |       |       |                |
| 000267 | 074041 | A | 125 |       | STX   | NOOMP          |
| 000270 | 005040 | A | 126 |       | TXB   |                |
| 000271 | 014036 | A | 127 |       | LDA   | WORK           |
| 000272 | 164053 | A | 128 |       | MUL   | D120           |
| 000273 | 005021 | A | 129 |       | TBA   |                |
| 000274 | 005021 | A | 130 |       | TBA   |                |
| 000275 | 005002 | A | 131 |       | TXB   |                |
| 000276 | 144047 | A | 132 | NXT1  | SUB   | D120           |

|        |        |   |     |        |                               |
|--------|--------|---|-----|--------|-------------------------------|
| 000277 | 006255 | A | 133 | STAE   | STRCMP-1,X,0200               |
| 000300 | 000426 | R |     |        |                               |
| 000301 | 006275 | A | 134 | STXE   | RECNO-1,X,0200                |
| 000302 | 000346 | R |     |        |                               |
| 000303 | 006245 | A | 135 | INRE   | RECNO-1,X,0200                |
| 000304 | 000346 | R |     |        |                               |
| 000305 | 006265 | A | 136 | STBE   | NCHPS-1,X,0200                |
| 000306 | 000376 | R |     |        |                               |
| 000307 | 005344 | A | 137 | DXR    |                               |
| 000310 | 001646 | A | 138 | JXNZ   | NXT1                          |
| 000311 | 000276 | R | 139 | OPEN   | FCB,30                        |
| 000312 | 006505 | A |     |        |                               |
| 000313 | 000251 | E |     |        |                               |
| 000314 | 100000 | A |     |        |                               |
| 000315 | 003036 | A |     |        |                               |
| 000316 | 000334 | R |     |        |                               |
| 000317 | 000000 | A |     |        |                               |
| 000320 | 000000 | A |     |        |                               |
| 000321 | 002000 | A | 140 | CALL   | RETRN                         |
| 000322 | 000070 | R |     |        |                               |
| 000323 | 001000 | A | 141 | JMP    | *                             |
| 000324 | 000323 | R |     |        |                               |
| 000324 |        |   | 142 | OP\$N  | BES 0                         |
| 000325 | 002000 | A | 143 | CALL   | #SE,2                         |
| 000326 | 000215 | E |     |        |                               |
| 000327 | 000002 | A |     |        |                               |
| 000330 | 000000 | A | 144 | WORK   | DATA 0                        |
| 000331 | 000000 | A | 145 | NCOMP  | DATA 0                        |
| 000332 | 001000 | A | 146 | JMP    | OPN1                          |
| 000333 | 000263 | R |     |        |                               |
|        |        |   | 147 | FCB    | FCB 120,*0,, 'PL', 'OT', 'FL' |
| 000334 | 000170 | A |     |        |                               |
| 000335 | 000334 | R |     |        |                               |
| 000336 | 000000 | A |     |        |                               |
| 000337 | 000000 | A |     |        |                               |
| 000340 | 000000 | A |     |        |                               |
| 000341 | 000000 | A |     |        |                               |
| 000342 | 000000 | A |     |        |                               |
| 000343 | 150314 | A |     |        |                               |
| 000344 | 147724 | A |     |        |                               |
| 000345 | 143314 | A |     |        |                               |
| 000346 | 000170 | A | 148 | D120   | DATA 120                      |
| 000347 |        |   | 149 | RECNO  | BSS 24                        |
| 000377 |        |   | 150 | NCHPS  | BSS 24                        |
| 000427 |        |   | 151 | STRCMP | BSS 24                        |
|        |        |   | 152 | END    |                               |

# ENTRY NAMES

000213 R ADDCMP 000013 R CLO#1 000243 R CLO#E 000324 R OP\$N  
000000 R OP#H1 000145 R RETRIV

# EXTERNAL NAMES

000326 E #SE 000313 E V#IOC

# SYMBOLS

|                 |                |                 |                 |
|-----------------|----------------|-----------------|-----------------|
| 000326 E \$SE   | 000217 R A     | 000155 R ADDCM1 | 000213 R ADDCMP |
| 000002 A B      | 000013 R CLOS1 | 000243 R CLOS1  | 000346 R D120   |
| 000334 R FCB    | 000152 R ICM1  | 000220 R ICOMP  | 000317 R NCMP5  |
| 000331 R HCOMP  | 000276 R NXT1  | 000324 R OPIN   | 000000 R OPIN1  |
| 000263 R OPN1   | 000026 R RDW   | 000047 R RDW1   | 000120 R READ   |
| 000347 R RECNO  | 000206 R RET1  | 000101 R RETR1  | 000145 R RETRIV |
| 000070 R RETRN  | 000062 R SAVE  | 000076 R STA    | 000077 R STB    |
| 000427 R STRCMP | 000100 R STX   | 000422 A TWO    | 000313 E VBIOT  |
| 000151 R WHERE  | 000330 R WORK  | 000223 R WRITE  | 000001 A X      |

0 ERRORS ASSEMBLY COMPLETE



C.

TEKTRONIX PLOTTING ROUTINES

A SERIES OF PLOTTING ROUTINES HAS BEEN ADDED TO THE SYSTEM TO ENABLE PLOT FILES IN VARIAN DATAPLOT FORMAT TO BE OUTPUT TO THE TEKTRONIX 4014. THESE ROUTINES SCALE A STATOS PLOT SO THAT ONE INCH ON THE STATOS EQUALS ONE INCH ON CRT, NOT ON THE HARDCOPY. THESE ROUTINES ARE TRANSPARENT TO THE USER, WITH THE FOLLOWING EXCEPTIONS:

- 1) CARE SHOULD BE USED WITH NEGATIVE ORIGINS (in inches)
- 2) PRINTS BEYOND THE SCREEN LIMITS END UP AT THE RIGHT HAND AND TOP LIMITS OF THE SCREEN
- 3) ALL CHARACTERS ARE PLOTTED AT THE CURRENT CHARACTER SIZE (see TEKFNC below) AND UPRIGHT-ORIENTATION
- 4) SPECIAL CHARACTERS HAVE NOT BEEN IMPLEMENTED
- 5) MINIMIZATION OF STATOS SORT AND PLOT TIMES MAY INCREASE TEKTRONIX PLOT TIMES

IN ADDITION, A SUBROUTINE TEKFNC HAS BEEN WRITTEN TO ENABLE THE USER ACCESS TO TEKTRONIX FUNCTIONS.

USAGE:

TO OUTPUT TO THE TEKTRONIX, ADD THE FOLLOWING SUBROUTINES TO ANY DATAPLOT PROGRAM:

```
SUBROUTINE DPSORT
CALL CRTPLT
RETURN
END
SUBROUTINE DPLOT
RETURN
END
```

TO USE TEKTRONIX FUNCTIONS:

CALL TEKFN(1)

|        |                            |
|--------|----------------------------|
| 1----- | FUNCTION                   |
| 1----- | LARGEST CHARACTERS         |
| 2----- | 2ND LARGEST CHARACTERS     |
| 3----- | 3RD " "                    |
| 4----- | 4TH "(SMALLEST) CHARACTERS |
| 5----- | SOLID VECTORS              |
| 6----- | DOTTED VECTORS             |
| 7----- | DOT-DASHED VECTORS         |
| 8----- | SHORT-DASHED VECTORS       |
| 9----- | LONG-DASHED VECTORS        |

|        |          |           |       |                 |
|--------|----------|-----------|-------|-----------------|
|        |          | 1         | NAME  | CRTPLT, I\$BLD1 |
|        |          | 2         | EXT   | \$SE            |
|        | 000001 A | 3 X       | EQU   | 1               |
|        | 000002 A | 4 B       | EQU   | 2               |
|        | 000423 A | 5 FOUR    | EQU   | 0423            |
| 000000 | 000000 A | 6 CRTPLT  | ENTR  |                 |
|        |          | 7         | REM   | FCB, 8          |
| 000001 | 006505 A |           |       |                 |
| 000002 | 000000 E |           |       |                 |
| 000003 | 100000 A |           |       |                 |
| 000004 | 001410 A |           |       |                 |
| 000005 | 000133 R |           |       |                 |
| 000006 | 000000 A |           |       |                 |
| 000007 | 000000 A |           |       |                 |
|        |          | 8         | EXT   | I\$PLT          |
| 000010 | 006017 A | 9         | LDRE  | I\$PLT          |
| 000011 | 000000 E |           |       |                 |
| 000012 | 001016 A | 10        | JANZ  | AGAIN           |
| 000013 | 000023 R |           |       |                 |
|        |          | 11        | READ  | DOB1, 2, , 1    |
| 000014 | 006505 A |           |       |                 |
| 000015 | 000002 E |           |       |                 |
| 000016 | 100000 A |           |       |                 |
| 000017 | 010002 A |           |       |                 |
| 000020 | 000145 R |           |       |                 |
| 000021 | 000000 A |           |       |                 |
| 000022 | 000000 A |           |       |                 |
|        |          | 12 AGAIN  | READ  | FCB, 8          |
| 000023 | 006505 A |           |       |                 |
| 000024 | 000015 E |           |       |                 |
| 000025 | 100000 A |           |       |                 |
| 000026 | 000010 A |           |       |                 |
| 000027 | 000133 R |           |       |                 |
| 000030 | 000000 A |           |       |                 |
| 000031 | 000000 A |           |       |                 |
| 000032 | 014101 A | 13        | LDA   | FCB+1           |
| 000033 | 054005 A | 14        | STA   | CALSEQ          |
| 000034 | 006020 A | 15        | LDBI  | 30              |
| 000035 | 000036 A |           |       |                 |
| 000036 | 005322 A | 16 DBR    | DBR   |                 |
|        |          | 17        | EXT   | CONVRT          |
| 000037 | 002000 A | 18        | CALL  | CONVRT, 0       |
| 000040 | 000000 E |           |       |                 |
| 000041 | 000000 A |           |       |                 |
| 000041 |          | 19 CALSEQ | BES   | 0               |
| 000042 | 006017 A | 20        | LDRE* | CALSEQ          |
| 000043 | 100041 R |           |       |                 |
| 000044 | 006140 A | 21        | SUBI  | 32700           |
| 000045 | 077674 A |           |       |                 |
| 000046 | 001002 A | 22        | JAP   | CLSOT           |
| 000047 | 000061 R |           |       |                 |
| 000050 | 006017 A | 23        | LDRE  | CALSEQ          |
| 000051 | 000041 R |           |       |                 |

|        |        |   |    |         |                    |
|--------|--------|---|----|---------|--------------------|
| 000052 | 120423 | A | 24 | ADD     | FOUR               |
| 000053 | 006057 | A | 25 | STAE    | CALSEQ             |
| 000054 | 000041 | R |    |         |                    |
| 000055 | 001026 | A | 26 | JBNZ    | DBR                |
| 000056 | 000036 | R |    |         |                    |
| 000057 | 001000 | A | 27 | JNP     | AGAIN              |
| 000060 | 000023 | R |    |         |                    |
| 000061 | 014050 | A | 28 | CLSOT   | LDA DCBFN          |
| 000062 | 002016 | A | 29 | JANZM   | BUFOUT             |
| 000063 | 000121 | R |    |         |                    |
| 000064 | 001000 | A | 30 | RETU*   | CRTPLT             |
| 000065 | 100000 | R |    |         |                    |
| 000066 | 000000 | A | 31 | I\$BLD1 | ENTR               |
| 000067 | 002000 | A | 32 | CALL    | \$SE, 1            |
| 000070 | 000000 | E |    |         |                    |
| 000071 | 000001 | A |    |         |                    |
| 000072 | 000000 | A | 33 | ICAR    | DATA 0             |
| 000073 | 054016 | A | 34 | STA     | LDA+1              |
| 000074 | 064017 | A | 35 | STB     | LDB+1              |
| 000075 | 074020 | A | 36 | STX     | LDX+1              |
| 000076 | 006017 | A | 37 | LDAE*   | ICAR               |
| 000077 | 100072 | R |    |         |                    |
| 000100 | 034031 | A | 38 | LDX     | DCBFN              |
| 000101 | 044030 | A | 39 | INP     | DCBFN              |
| 000102 | 006255 | A | 40 | STAE    | 0BUF, X, 0200      |
| 000103 | 000340 | R |    |         |                    |
| 000104 | 005144 | A | 41 | IXP     |                    |
| 000105 | 005041 | A | 42 | TNA     |                    |
| 000106 | 144024 | A | 43 | SUB     | FCR                |
| 000107 | 002010 | A | 44 | JAZM    | BUFOUT             |
| 000110 | 000121 | R |    |         |                    |
| 000111 | 006010 | A | 45 | LDA     | LDAI               |
| 000112 | 000000 | A |    |         |                    |
| 000113 | 006020 | A | 46 | LDB     | LDBI               |
| 000114 | 000000 | A |    |         |                    |
| 000115 | 006030 | A | 47 | LDX     | LDXI               |
| 000116 | 000000 | A |    |         |                    |
| 000117 | 001000 | A | 48 | RETU*   | I\$BLD1            |
| 000120 | 100066 | R |    |         |                    |
|        |        |   | 49 | EXT     | OUTK2              |
| 000121 | 000000 | A | 50 | BUFOUT  | ENTR               |
| 000122 | 002000 | A | 51 | CALL    | OUTK2, 0BUF, DCBFN |
| 000123 | 000000 | E |    |         |                    |
| 000124 | 000340 | R |    |         |                    |
| 000125 | 000132 | R |    |         |                    |
| 000126 | 005001 | A | 52 | TNA     |                    |
| 000127 | 054002 | A | 53 | STA     | DCBFN              |
| 000130 | 001000 | A | 54 | RETU*   | BUFOUT             |
| 000131 | 100121 | R |    |         |                    |
|        |        |   | 55 | *       |                    |
| 000132 | 000000 | A | 56 | DCBFN   | DATA 0             |
|        |        |   | 57 | FCR     | FCR 120, IBUF, 1   |
| 000133 | 000170 | A |    |         |                    |



000134 000150 R  
 000135 000400 A  
 000136 000000 A  
 000137 000000 A  
 000140 000000 A  
 000141 000000 A  
 000142 000000 A  
 000143 000000 A  
 000144 000000 A

58 DCB1 DCB 30,IBUF

000145 000006 A  
 000146 000150 R  
 000147 000000 A  
 000150  
 000340

59 IBUF BSS 120  
 60 OBUF BSS 120  
 61 END

# ENTRY NAMES

000000 R CRTPLT 000066 R I\$BLD1

# EXTERNAL NAMES

000070 E \$SE 000040 E CONVRT 000011 E I\$PLT 000123 E OUTK2  
 000024 E V\$IOO

# SYMBOLS

000070 E \$SE 000023 R AGAIN 000002 A B 000121 R BUFOUT  
 000041 R CALSEQ 000061 R CLSOT 000040 E CONVRT 000000 R CRTPLT  
 000036 R DBP 000145 R DCB1 000132 R DCBEN 000133 R FCB  
 000423 A FOUR 000066 R I\$BLD1 000011 E I\$PLT 000150 R IBUF  
 000072 R ICAP 000111 R LDA 000113 R LDB 000115 R LDX  
 000340 R OBUF 000123 E OUTK2 000075 R STX 000024 E V\$IOO  
 000001 A X

0 ERRORS ASSEMBLY COMPLETE

```

1      SUBROUTINE CONVRT(INBLK)
2      DIMENSION INBLK(2,2)
3      DATA IGS/0/
4      DATA MAX,LX,LY,IHIY,IHIX/29700,4*-1/
5      IF(INBLK(1,1).LT.0) GO TO 99
6      IF(INBLK(1,1).GT.32700)GO TO 98
7      IL=1
8      IU=2
9      IF(INBLK(1,2).EQ.32764) IU=1
10     IOUT=0
11     DO 3 I=IL,IU
12     NX=MAX-INBLK(1,I)
13     IF(NX.LT.0)NX=0
14     IF(NX.GT.1430)NX=1430
15     NX=1#RST(NX)
16     IF(LX.NE.NX)IOUT=1
17     LX=NX
18     IHIY=32+ISHIFT(NX,5,3)
19     LOX=64+IAND(NX,31)
20     NY=INBLK(2,I)
21     IF(NY.GT.1089)NY=1089
22     NY=1#RST(NY)
23     IF(LY.NE.NY)IOUT=1
24     LY=NY
25     IHIY=32+ISHIFT(NY,5,3)
26     LOY=96+IAND(NY,31)
27     IF(I.EQ.2)GO TO 50
28     IF(IOUT.EQ.1)IGS=0
29     IF(IGS.EQ.0)CALL 1#BLD1(29)
30     IF(IGS+IOUT.EQ.0)GO TO 5
31     IF(IOUT.EQ.0)GO TO 55
32 56    IF(IHIY.NE.KHIY)CALL 1#BLD1(IHIY)
33     IF(LOY.NE.KLOY.OR.IHIX.NE.KHIX)CALL 1#BLD1(LOY)
34     IF(KHIX.NE.IHIX)CALL 1#BLD1(IHIX)
35 5    CALL 1#BLD1(LOX)
36 55    KHIX=IHIX
37     KLOY=LOY
38     KHIY=IHIY
39 3    IOUT=1
40     IGS=1
41     IF(INBLK(1,2).NE.32764)RETURN
42     CALL 1#BLD1(31)
43     CALL 1#BLD1(INBLK(2,2))
44     IGS=0
45     RETURN
46 99    CALL 1#BLD1(27)
47     CALL 1#BLD1(INBLK(2,2))
48     RETURN
49 98    IGS=0
50     LX=-1
51     LY=-1
52     KHIY=-1
53     KHIX=-1
54     RETURN
55     END
0 ERRORS COMPILATION COMPLETE
/PFILE,PI,,CRTPLT
/DASMR,B

```

|        |        | 1  | NAME         | I\$RAST |
|--------|--------|----|--------------|---------|
|        |        | 2  | EXT          | \$SE    |
| 000000 | 000000 | 3  | I\$RAST ENTR |         |
| 000001 | 002000 | 4  | CALL         | \$SE    |
| 000002 | 000000 |    |              |         |
| 000003 | 000001 | 5  | DATA         | 1       |
| 000004 | 000000 | 6  | NX DATA      | 0       |
| 000005 | 004014 | 7  | STB          | STB     |
| 000006 | 006027 | 8  | LDBE*        | NX      |
| 000007 | 100004 |    |              |         |
| 000010 | 006010 | 9  | LDRI         | 715     |
| 000011 | 001313 |    |              |         |
| 000012 | 006160 | 10 | MULI         | 1023    |
| 000013 | 001277 |    |              |         |
| 000014 | 006170 | 11 | DIVI         | 1430    |
| 000015 | 002626 |    |              |         |
| 000016 | 005021 | 12 | TBA          |         |
| 000017 | 024002 | 13 | LDB          | STB     |
| 000020 | 001000 | 14 | RETU*        | I\$RAST |
| 000021 | 100000 |    |              |         |
| 000022 | 005000 | 15 | STB NOP      |         |
|        |        | 16 | END          |         |

ENTRY NAMES

000000 R I\$RAST

EXTERNAL NAMES

000002 E \$SE

SYMBOLS

000002 E \$SE      000000 R I\$RAST    000004 R NX

000022 R STB

0 ERRORS ASSEMBLY COMPLETE

|                 |          | 1        | NAME  | TEKFNC                              |
|-----------------|----------|----------|-------|-------------------------------------|
|                 |          | 2        | EXT   | \$SE, V\$DPVE, V\$DPIV              |
| 000002 A        |          | 3 B      | EQU   | 2                                   |
| 000000 000000 A |          | 4 TEKFNC | ENTR  |                                     |
| 000001 002000 A |          | 5        | CALL  | \$SE, 1                             |
| 000002 000000 E |          |          |       |                                     |
| 000003 000001 A |          |          |       |                                     |
| 000004 000000 A |          | 6 IFUNC  | DATA  | 0                                   |
| 000005 054027 A |          | 7        | STA   | STA                                 |
| 000006 064030 A |          | 8        | STB   | STB                                 |
| 000007 006027 A |          | 9        | LDBEX | IFUNC                               |
| 000010 100004 R |          |          |       |                                     |
| 000011 005322 A | 10       |          | DBR   |                                     |
| 000012 005021 A | 11       |          | TBA   |                                     |
| 000013 001004 A | 12       |          | JAN   | RET                                 |
| 000014 000034 R |          |          |       |                                     |
| 000015 144035 A | 13       |          | SUB   | MAX                                 |
| 000016 001002 A | 14       |          | JAP   | RET                                 |
| 000017 000034 R |          |          |       |                                     |
| 000020 006216 A | 15       |          | LDAE  | TABLE, B, 0200                      |
| 000021 000042 R |          |          |       |                                     |
| 000022 006020 A | 16       |          | LDBI  | V\$DPVE                             |
| 000023 000000 E |          |          |       |                                     |
| 000024 056003 A | 17       |          | STA   | 3, B                                |
| 000025 006010 A | 18       |          | LDAI  | 077774                              |
| 000026 077774 A |          |          |       |                                     |
| 000027 050002 A | 19       |          | STA   | 2, B                                |
| 000030 005301 A | 20       |          | DECR  | 01                                  |
| 000031 056000 A | 21       |          | STA   | 0, B                                |
| 000032 002000 A | 22       |          | CALL  | V\$DPIV                             |
| 000033 000000 E |          |          |       |                                     |
| 000034 006010 A | 23 RET   |          | LDAI  | 0                                   |
| 000035 000000 A |          |          |       |                                     |
| 000035          | 24 STA   |          | RES   | 0                                   |
| 000036 006020 A | 25       |          | LDBI  | 0                                   |
| 000037 000000 A |          |          |       |                                     |
| 000037          | 26 STB   |          | BES   | 0                                   |
| 000040 001000 A | 27       |          | RETUX | TEKFNC                              |
| 000041 100000 R |          |          |       |                                     |
| 000042 000070 A | 28 TABLE |          | DATA  | 56, 57, 58, 59, 96, 97, 98, 99, 100 |
| 000043 000071 A |          |          |       |                                     |
| 000044 000072 A |          |          |       |                                     |
| 000045 000073 A |          |          |       |                                     |
| 000046 000140 A |          |          |       |                                     |
| 000047 000141 A |          |          |       |                                     |
| 000050 000142 A |          |          |       |                                     |
| 000051 000143 A |          |          |       |                                     |
| 000052 000144 A |          |          |       |                                     |
| 000053 000011 A | 29 MAX   |          | DATA  | 9                                   |
|                 | 30       |          | END   |                                     |

ENTRY NAMES

000000 R TEKFNC

EXTERNAL NAMES

000002 E \$SE 000033 E V\$DPIV 000023 E V\$DPVE

SYMBOLS

000002 E \$SE 000002 A B 000004 P IFUNC 000053 R MAX  
 000034 R RET 000035 R STA 000037 R STB 000042 R TABLE

000000 R TEKFNC 000033 E V\$DPIV 000023 E V\$DPVE

0 ERRORS ASSEMBLY COMPLETE



## II. DATA ANALYSIS

A program to produce magnetograms from the AFGL Magnetometer Network data was written. The program is to be run on the Varian computer and the magnetograms are hard copies of a Cathod Ray Tube (CRT) display.

The program is run by typing in on the CRT keyboard /LOAD, DEMO

The program DEMO then prompts the programmer  
ENTER START HOUR OR 99 FOR BOT.

93 FOR CURRENT TAPE POSITION, 97 FOR DISK DATA

If you want to begin the magnetogram at a particular hour enter that hour as hh. If the magnetogram is to begin at the beginning of the TAPE (BOT) enter 99, if it is to begin from the current position of the tape enter 93. If the magnetogram is to be made from data already on disk enter 97.

ENTER START TIME FOR GRAPH IF DIFFERENT

The magnetograms should begin on the hour, but if the data to be plotted do not begin on the hour, enter a starting hour. For example say the data begin at 17:37, the programmer may enter 17 as the starting hour of the magnetogram. otherwise enter RETURN

ENTER START DAY IF DIFFERENT FROM CURRENT TAPE DAY

If the tape is positioned on day 213 for example and you want a magnetogram beginning on day 214 then enter 214. Otherwise enter RETURN.

ENTER NUMBER OF HOURS AND NUMBER OF PERIODS IF NOT 1 (HHPP)

Enter the length of the magnetograms in hours and the desired number of magnetograms. If you want seven eight hour magnetograms enter 0708. If only eight hour magnetogram is wanted enter 08.

AUTO HARD COPY (Y,N)?

If you want hard copies of the magnetograms produced automatically enter Y, if not enter N.

INDIVIDUAL PLOTS, OVERLAY PLOT, OR BOTH (I,O,B)?

If you want an individual plot of each station and no overlay

enter 1, if you want an overlay and no individual plots  
enter 0. If you want both enter 8.

DEMO is a highly automated program. Once all the entries have been made all that is required of the programmer is that he change the tapes if the magnetogram requires more than one tape and that he terminate the program. The program is terminated by simply entering a / RETURN.

An example of the prompting sequence and the resulting magnetograms is shown in Figures 3 thru 9. These are the plots of X, Y, and Z components of the seven network stations, in order: MA, FL, MI, WI, SD, CA, WA. Figure 10 is a composite of all seven stations.

Figures 1 and 2 are plots of LINCHK for the selected date of the magnetograms, and give an overall view (for that date) of the quality of operation of the network for each station.

#### To use LINCHK

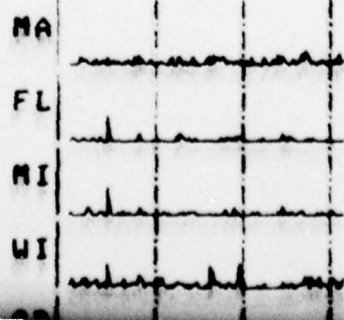
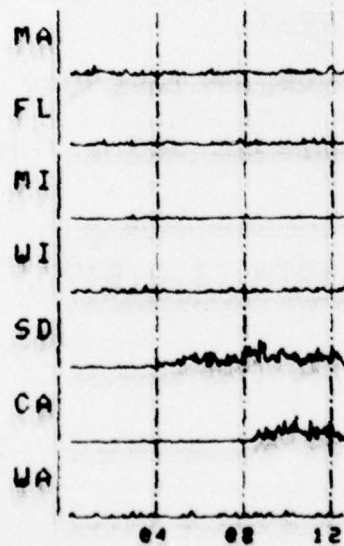
Load the tape of interest and type on the CRT  
keyboard /LOAD,LINCHK

ENTER START HOUR OR 99 FOR BOT,  
93 FOR CURRENT TAPE POSITION, 97 FOR DISK DATA  
08  
ENTER START TIME FOR GRAPH IF DIFFERENT  
ENTER START DAY IF DIFFERENT FROM CURRENT TAPE DAY  
155  
ENTER NUMBER OF HOURS AND # OF PERIODS IF NOT 1 (HHPP)  
12  
AUTO HARD COPY (Y,N)?  
Y  
INDIVIDUAL PLOTS, OVERLAY PLOT, OR BOTH (I,O,B)?  
B



8048/00:04 TO 8048/12:46

FILE 2



8048/00:04 TO 8048/12:46

FILE 2

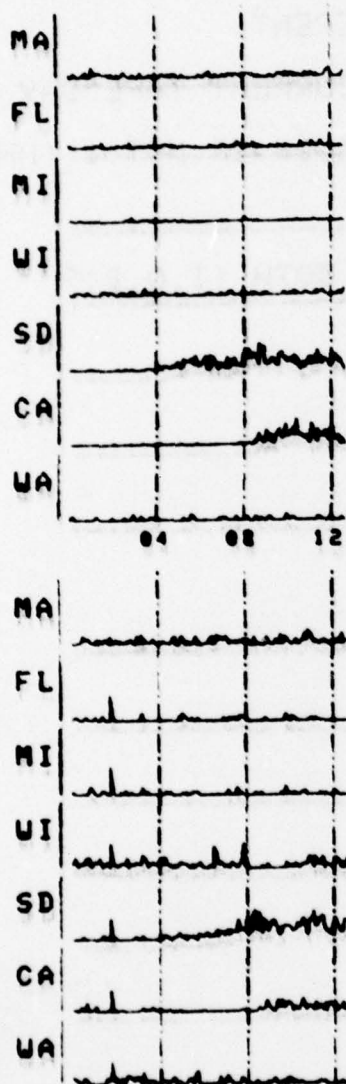


Figure 1.

8048 12:46 TO 8050/03:27 FILE 1

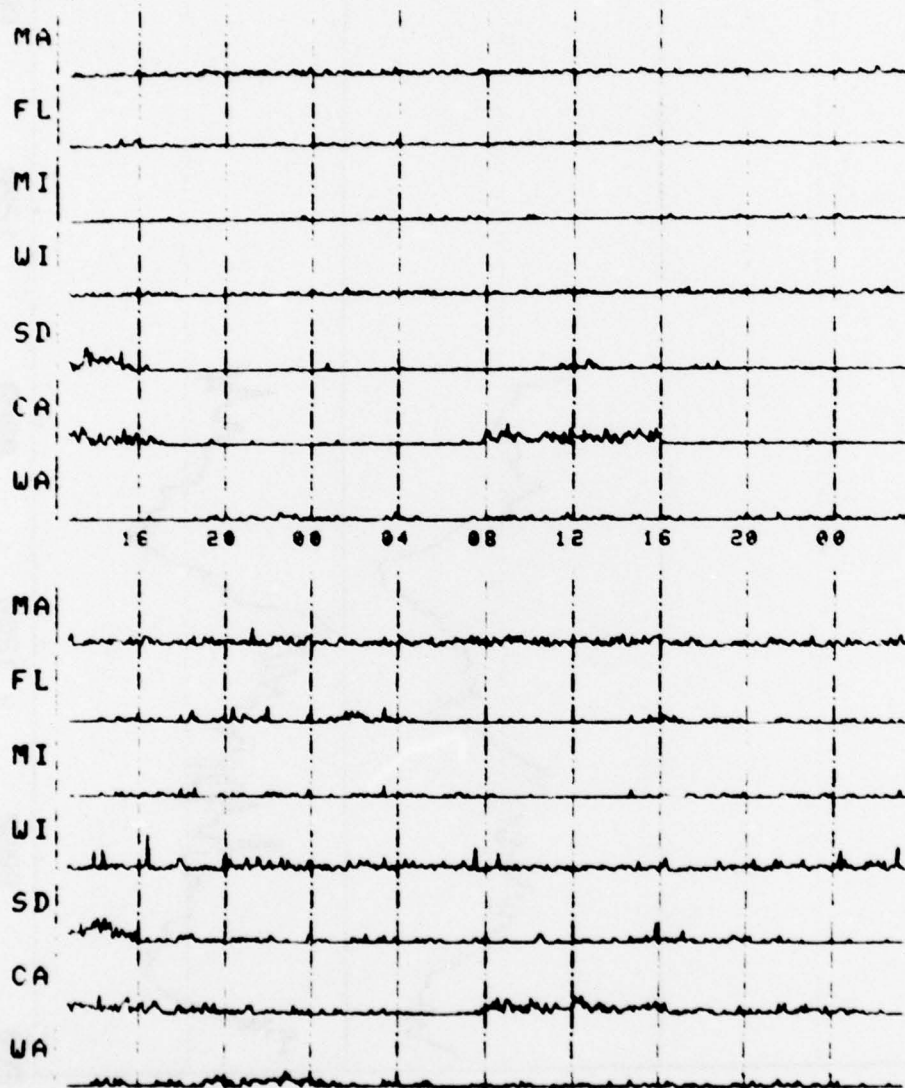


Figure 2.

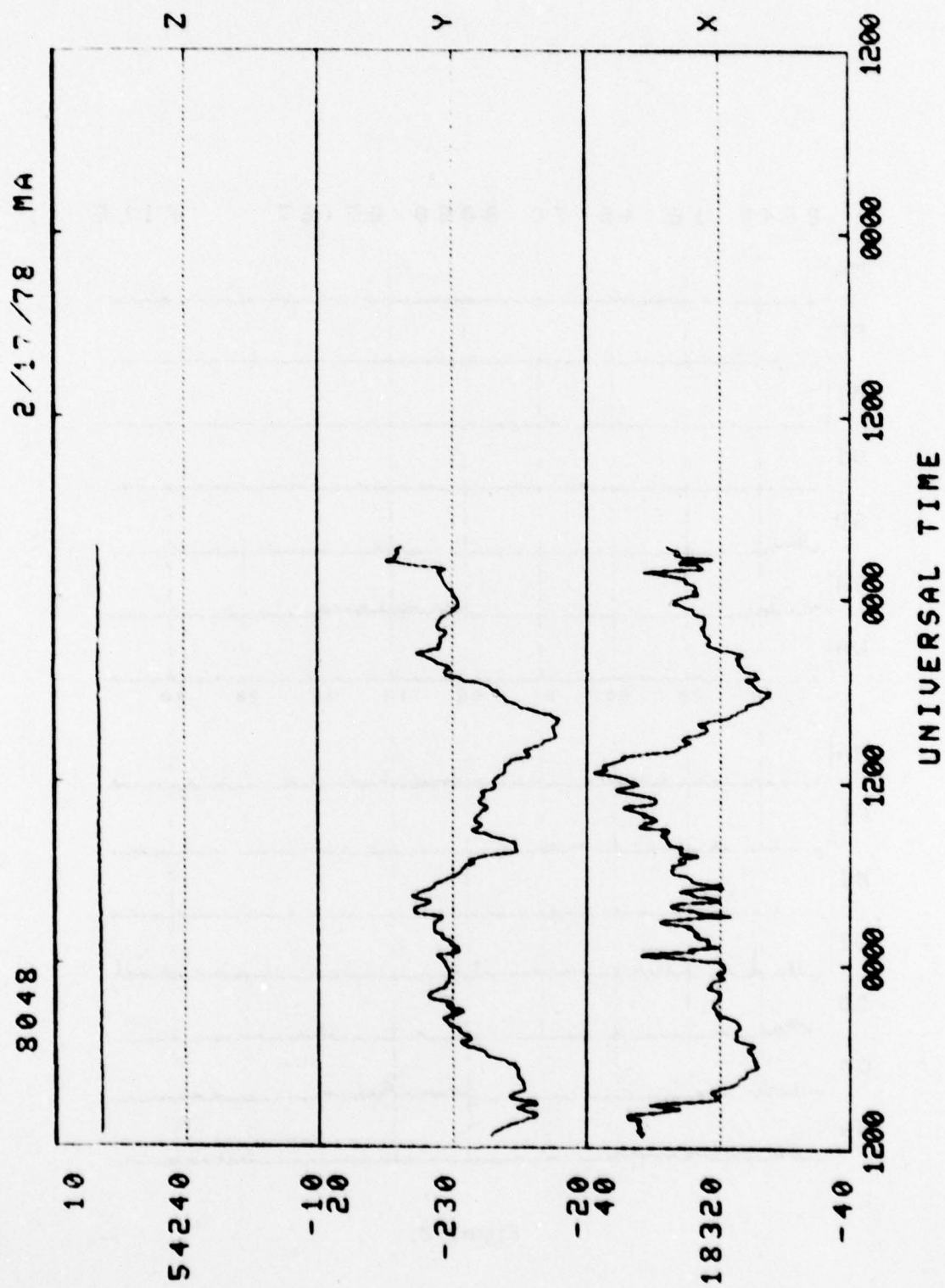


Figure 3.



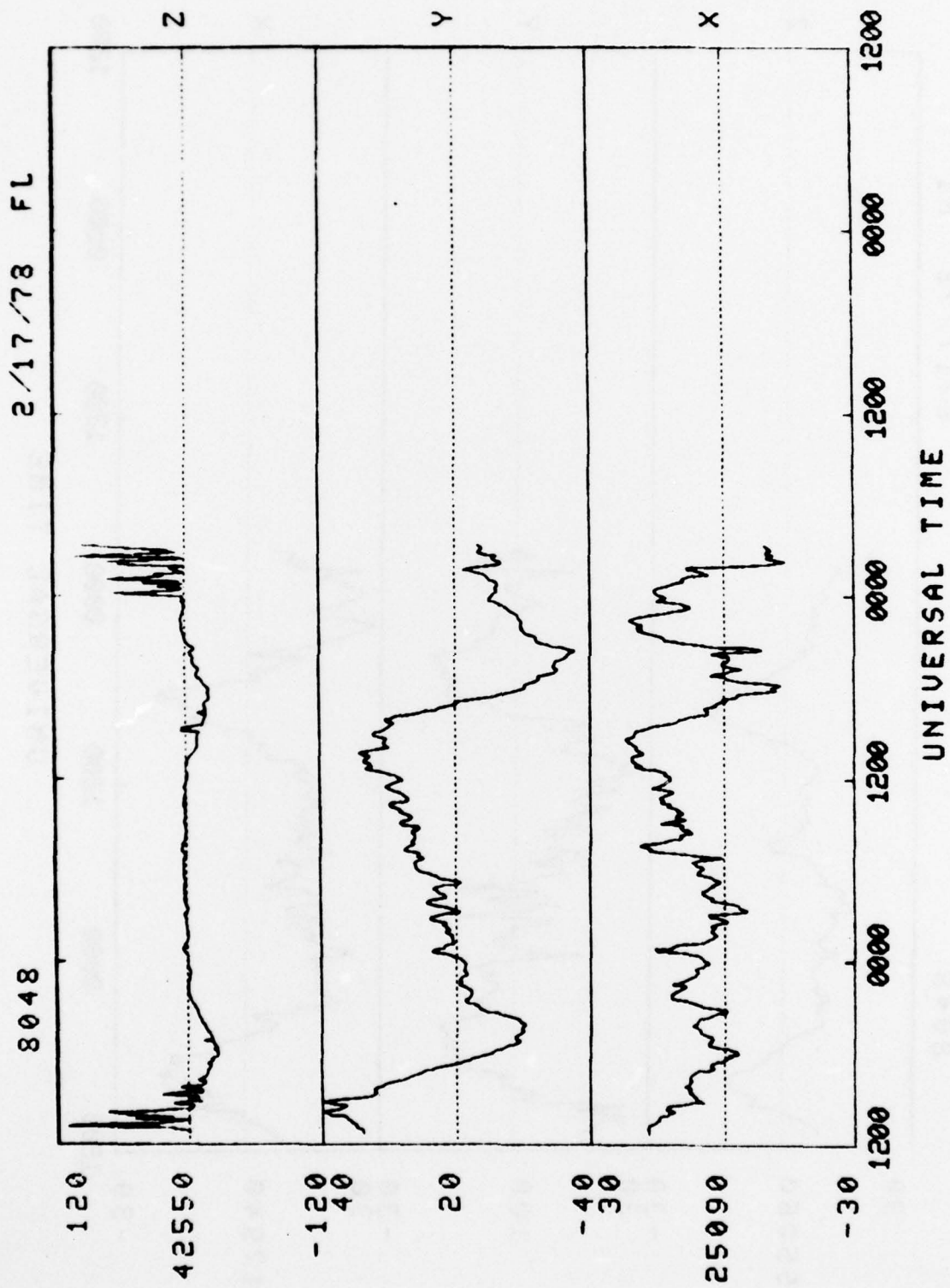


Figure 4.

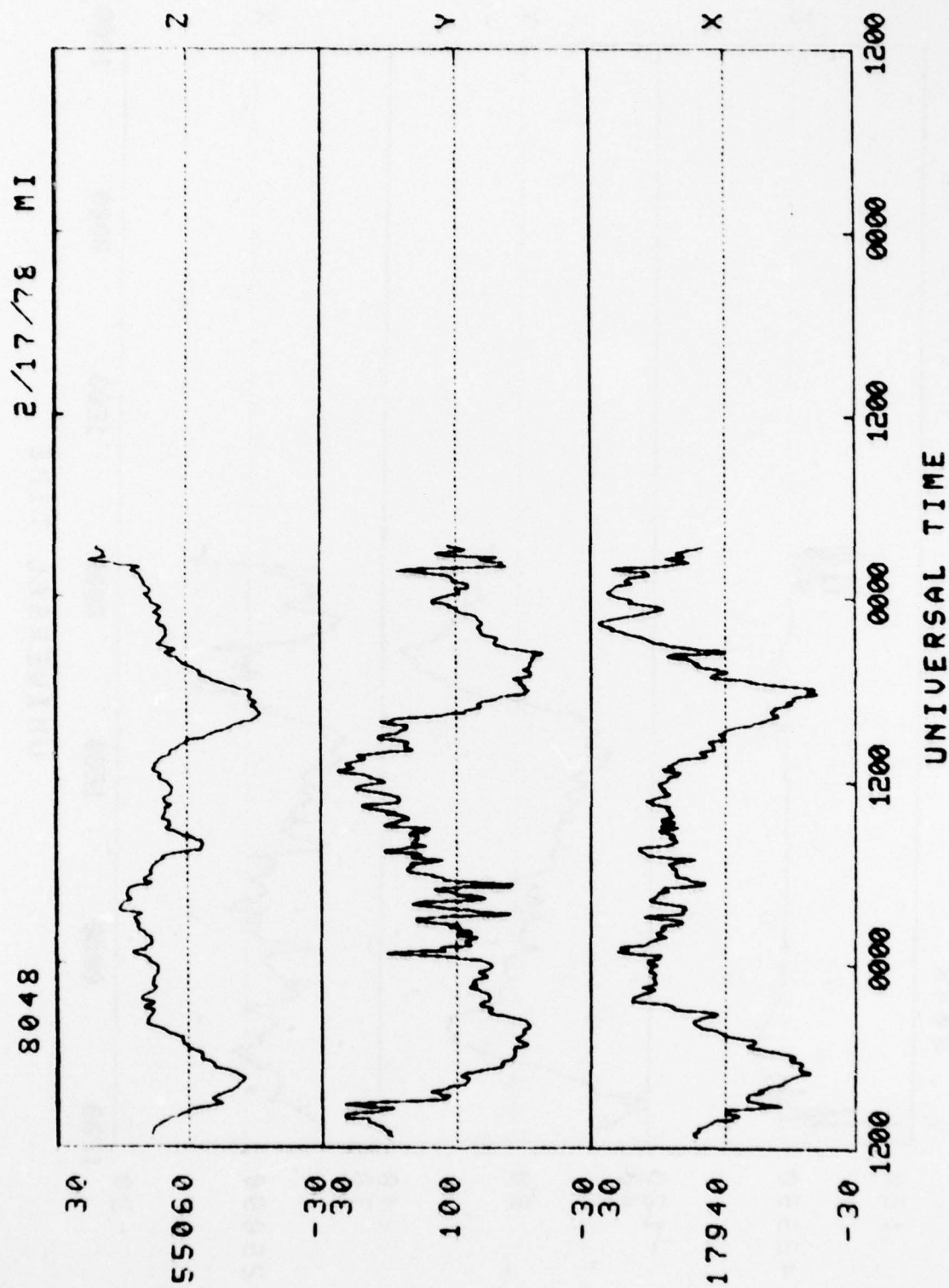


Figure 5.

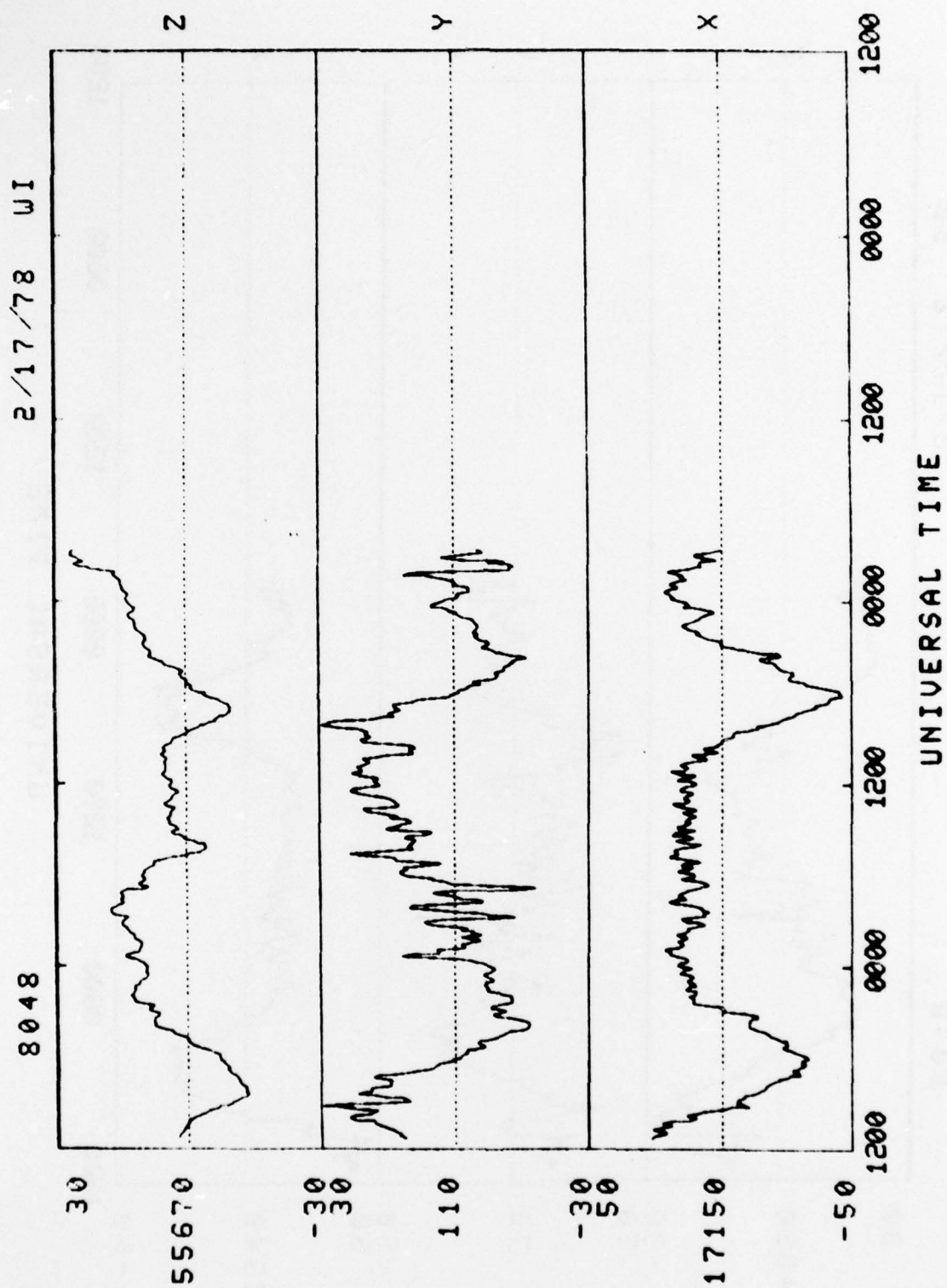


Figure 6.

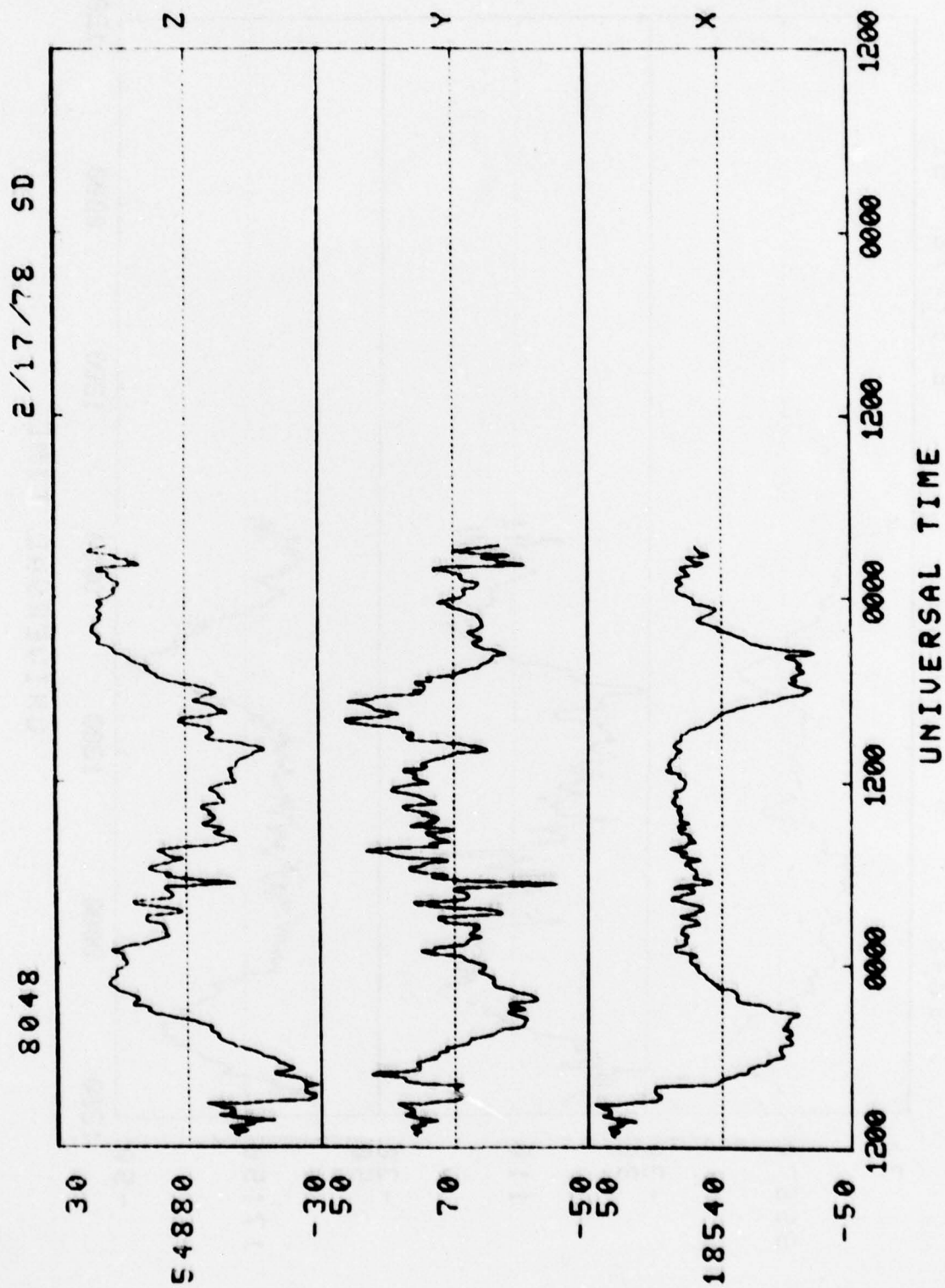


Figure 7.



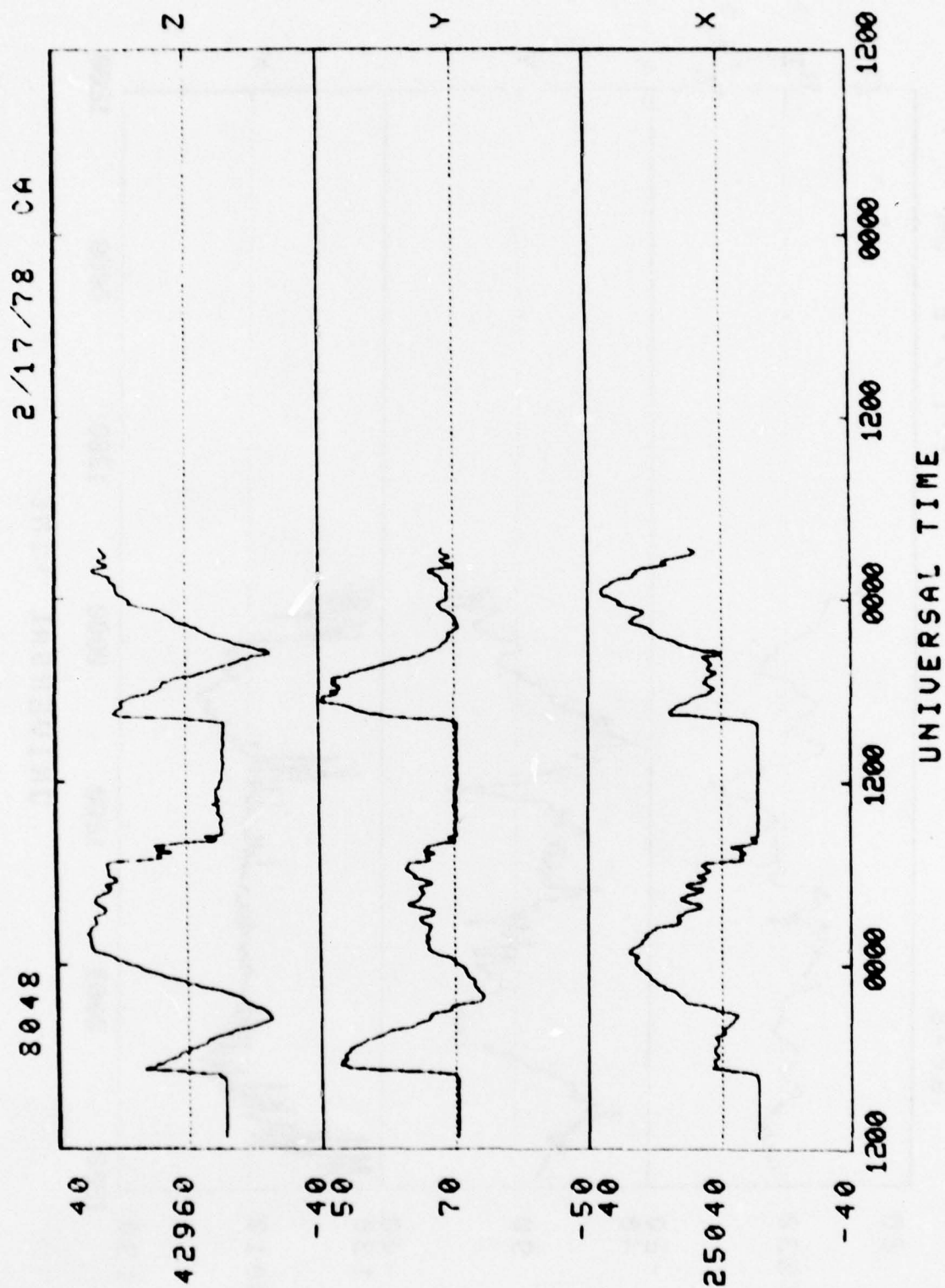


Figure 8.

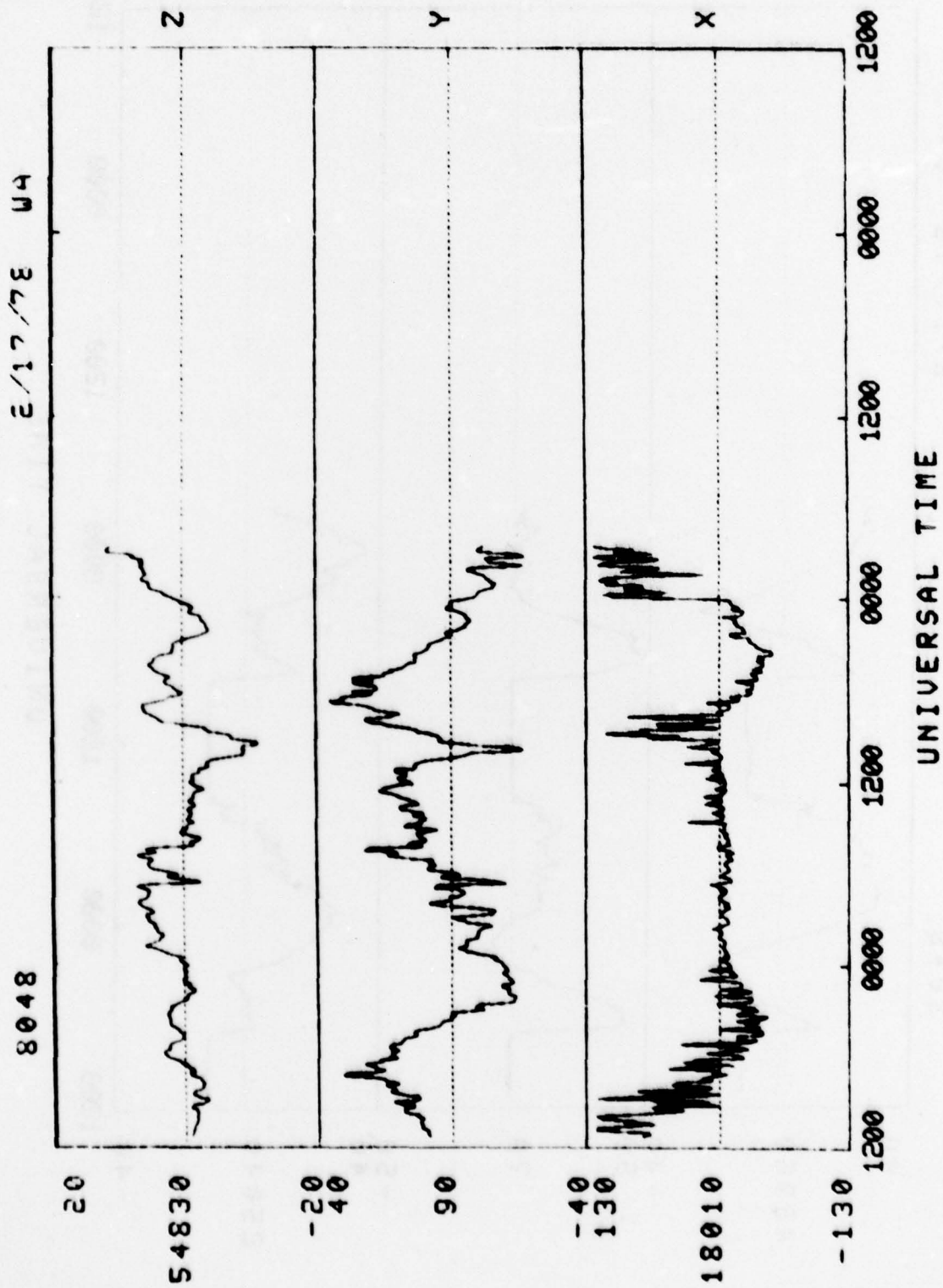


Figure 9.

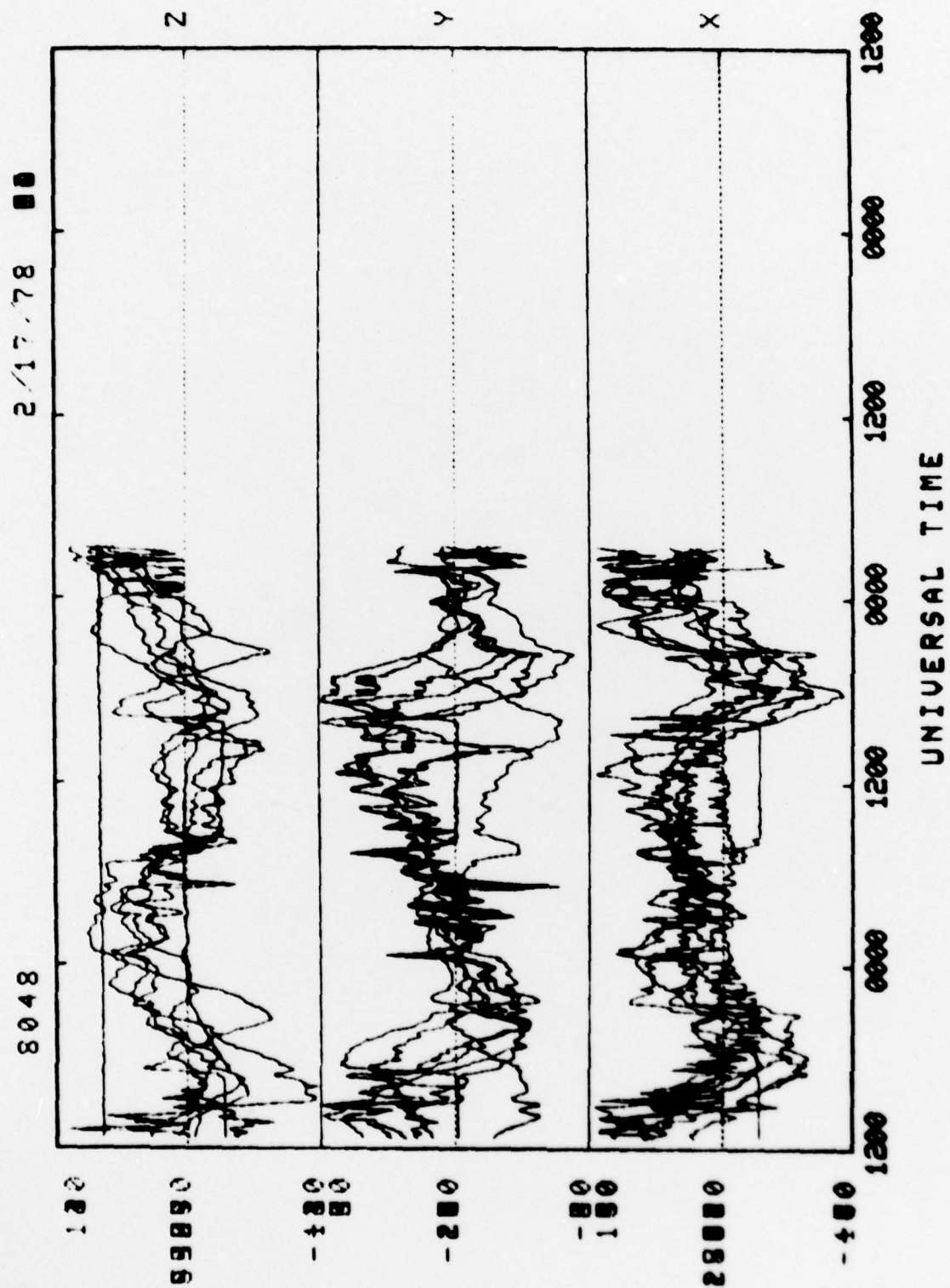


Figure 10.